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**REGISTER**  
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**ARTS AND SCIENCES.**

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**VOLUME THE FOURTH.**

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## ADDRESS

*On the conclusion of the First Series of this Work, and announcement of a  
New and Improved Series.*

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AT the close of the Fourth Volume, and of the First Series of our Work, we are bound no less by established custom, than by a proper feeling of gratitude, to express our thanks to our numerous *Subscribers* for their patronage, and to our intelligent *Correspondents* for their valuable Communications; and in anticipating a continuance of their kindness and assistance, in the New SERIES of the Work, already announced, we trust we shall not be disappointed.

That our humble efforts to further the diffusion of useful knowledge, by recording the valuable inventions and discoveries, effected by the genius and perseverance of our Countrymen, have hitherto met with the general approbation of our Subscribers, is attested by the increasing circulation of the Work; but we hardly expected the unsought commendations, bestowed upon it by men of the greatest intellect and attainments in science; among whom we may mention as the most conspicuous, the amiable and learned President of the London Mechanics' Institution.

The very numerous and correct Illustrations with which the present Volume is embellished, furnish sufficient evidence of our *desire*, to make the Work as perspicuous as it is useful: in this department it will be seen, that we have spared neither trouble nor expense, as the Engravings exceed two-fold that of any other Work extant. With respect to the nature and merits of the subjects, we believe it is universally admitted that no Periodical of the present time can boast of a greater variety of original *practical* improvements in Mechanics, than the REGISTER OF THE ARTS AND SCIENCES.

Nevertheless, being persuaded that it is possible to increase the subjects both in number and interest, and that we cannot individually devote more time to the work than we have already done, we shall avail ourselves in the

*New Series*, of the promised regular assistance of Mr ROBERT CHRISTIE, the Secretary of the London Mechanics' Institution, whose well known acquaintance with physical science, as well as the practice of Mechanics, eminently qualifies him for the task.

The first number of the New Series will be published on the 10th July next, price four-pence, and be continued on every succeeding *tenth* day; namely, on the 10th, 20th, and 30th of each month. On the last day of the month, the three numbers will be put in a neat wrapper, and form a REGULAR MONTHLY PERIODICAL, *price one shilling*, which will be delivered in the country on the first day of every succeeding month. With the view of distinguishing its title from that of a respectable contemporaneous work, which was commenced subsequently to it, it is determined to alter *the title of the New Series* to

REGISTER OF THE ARTS, AND JOURNAL OF PATENT INVENTIONS;

in which will be exhibited, the progressive improvements made in every branch of practical mechanics, including the *earliest* description of every new patented invention of utility or importance; the whole of which will be illustrated by numerous clear engravings, mostly made from original drawings by the Editor.

The want of sufficient space, to do justice to the admirable lectures delivered at the London Mechanics' Institution, will oblige us to omit inserting reports of them, (except occasionally such parts as may relate to any *new* scientific fact, or to the description of any new machine;) but the members, and our readers generally, may depend upon a faithful and regular notice of its proceedings, and for the timely announcement, of all the arrangements made for lectures and other business, by anticipation. The New Series will likewise contain a similar periodical notice, of the proceedings of *all* the other Scientific and Literary Institutions of the Metropolis: these notices will be uniform and concise, and placed under one head; and will, we trust, form a body of pleasing and convenient intelligence, to a great body of our Subscribers.

# REGISTER

OF

## THE ARTS AND SCIENCES.

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**No. 73.]      SATURDAY, MAY 20, 1826.      [Price 4d.**

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**M'CURDY'S PATENT**  
**"FRANKLIN DUPLEX STEAM GENERATORS."**

## REGISTER OF THE

## Mc. CURDY'S PATENT

## "FRANKLIN DUPLEX STEAM GENERATORS."

THE inconvenient size, great expense, and personal hazard attending the use of the ordinary boilers to steam engines, have of late years excited the attention, and employed the talents, of many scientific and ingenious men, to devise a less objectionable mode of generating steam; numerous have been the plans proposed to effect it, and some degree of merit has (as far as our observation has extended) been due to most of them. The efforts of the several inventors and patentees, who have of late years put forth their contrivances before the public, seem to have been uniformly directed to one point, viz. the exposure of the smallest quantity of water to the largest heated surface, at that particular temperature which will generate the steam most economically, and at the same time of sufficient elastic force. Vast sums of money have been uselessly expended in attempting to accomplish this important desideratum, attributable, we believe, not to the want of mechanical skill or intelligence, but to the deficiency of accurate chemical data, whereupon ingenious men might safely exercise their talents in the construction of suitable apparatus. The invention we have now to describe consists of a series of double tubes, placed one within another, which are arranged in any required number in a furnace of sufficient capacity, with the spaces between the exterior and interior tubes filled with water, by which a very extended and thin volume of water is exposed to the influence of the fire. The specification, from which we derive our information, being before us, we annex the following extracts from that document, as sufficiently explanatory of the details.

—"My invention of certain improvements in generating steam consist in a new combination of materials, or the adaptation and application of old and well known substances to produce or effect a particular purpose; which is both novel and useful, and which from their form I denominate 'Franklin Duplex Steam Generators.' For this purpose, I construct one or more vessels or tubes of any given number, length, or diameter, proportionate to the size of the engine, or quantity of steam wanted, made of wrought or cast iron, or other material of sufficient strength; which tubes or vessels are closed at both ends; on one end of each of which a head is fixed, that can be taken off at pleasure. Inside of each of these vessels or tubes I insert, or suspend in the centre, another vessel or tube of still smaller size, of similar materials, leaving a small space on all sides, varying according to their size from one quarter of an inch, to one inch and a half (according to the station they occupy in the furnace, near the fire or more remote) which is thought sufficient for the generators attached to an engine of the largest size: *between the outer and inner tubes or vessels.* The inner tubes or vessels are rendered steam tight, and closed at both ends, except such number as are placed within the reservoirs or 'steamometers' as I term them, and which are intended to contain a body of steam for the supply of the engine: or the minor tubes or vessels may be omitted entirely in this combination in the

steamometers or vessels intended to contain the steam. I place these tubes or vessels thus arranged, which I term duplex steam generators, in a common heated furnace in the same manner as gas retorts, or in the most advantageous manner for heating. The tubes or vessels at the top, or next communicating with the engine, are the most suitable to be reserved for the reservoirs or steamometers, and which I should generally make to contain about ten times the solid contents of the working cylinder of the engine. The outer or exterior vessels or tubes are connected by pipes leading from one to the other, which connecting pipe ought to lead from the upper part of one tube to the upper part of another, through which the steam and water rushes, from the time it is injected by the forcing pump, which I use to supply them with water till it passes into the steamometer, and from thence through the eduction pipe, which I insert into the *lower part or bottom* of the steamometer (whereas in boilers the steam is carried out at the top) into the engine. Into each of the interior tubes or vessels (closed at both ends) may be inserted small pipes, passing from the inner tubes or vessels through the outer ones into the open air, to permit any water or steam that might be forced into the inner vessels or tubes by the pressure of the steam, to escape. To keep the interior tubes or vessels in their places; and at equal distance from the outer ones, I put around them spiral bands; extending the whole length of the inner tubes or vessels, or rings at intervals, of from one to two feet apart, or pins of the same thickness as the space intended to be preserved as a water line; these rings are grooved all round, or have holes drilled in them to permit the free passage of the steam and water; and if the heat should cause the outer tubes or vessels to warp or yield, the same distance will always be preserved between the outer and inner tubes and vessels, and also prevent them from coming in contact in any part. A number of the 'duplex generators' may also be connected with the common boiler, for the generation of steam, the water being forced through them by the pump, and discharging into the steam chamber of the boiler in lieu of the steamometer."

"In the preceding engravings, Fig. 1 represents a front view of a furnace containing five "duplex generators," *a* 1, 2, 3, 4, 5, and one "steamometer" *b*. Fig. 2 is a view of the opposite end of the same furnace, with the cast iron plate which encases it broken away, to show the interior of the furnace, the hemispherical ends of the tubes, the communication from one to the other by means of short bent pipes, and the manner in which the fire acts upon them when so placed; the letters of reference designating the same parts in this figure as in all the others. Fig. 3 represents a cross section of the *outer tube* of a "duplex generator," and one of the hemispherical ends of the inner tube, with the space or "water line" between the two, preserved at a uniform distance apart by the interposition of narrow pieces of metal. Fig. 4 is a front end view of a "steamometer," with the flanch removed. Fig. 5 is a horizontal section of two "duplex generators," and one "steamometer" between them; in the former, the interior tubes *c c* are not shewn in section, but

whole, that it may be seen they are perfectly closed at each end, from which the water is compelled to assume the shape of a hollow cylinder. In the "steamometer" *b*, the interior tube *d* is left open at one end, for the steam to enter and become a reservoir for the supply of the engine.

"*e* is the water-pipe leading to the pump; *f* the pump; *g* the steam or eduction-pipe, leading from the "steamometer" into the engine. The mode of operation is as follows: each stroke of the pump introduces water into the vessel, *a* 1, (by the pipe *e*), which is forced or distributed around the spaces between the interior and exterior tube, termed the "water-line," in all the vessels. The steam generated in this first vessel, and the water that remains, is next forced through the connecting pipe into the second vessel, *a* 2; from thence successively through *a* 3, *a* 4, and *a* 5, then into the "steamometer" *b*, by the end always open; and from thence by the eduction-pipe *g* into the engine. The water injected by the pump at *c* has thus, in its passage from the pump to the engine, passed in a thin sheet over a heated surface of many thousand inches, and consequently the steam may be generated of a very high pressure with extraordinary rapidity.

"The patentee claims as original, First in the 'generators,' the combination of the materials, or tubes or vessels to produce the desired effect, by inserting or placing one vessel or tube within the other, in such a manner as to expose a small quantity of water over a large heated surface, by leaving a very minute space or passage between the outer and inner tubes or vessels, *the whole length as well as the two ends*. Second: He claims as original the leaving open one end of such number of interior tubes or vessels as may be necessary in the steamometers or reservoirs for steam to produce the desired effect. Third: He claims as original the 'steamometers,' or separate vessel for containing the steam, *with the eduction pipe placed in the lower part* to prevent the possibility of any accumulation of water. Fourth: He claims as original, in this combination to produce the desired effect, the rings, or spiral bands around the inner tubes or vessels, or pins filling the space at intervals between the outer and inner tubes or vessels, to produce the water-line. The advantages of this plan are, that the water being distributed in a thin sheet over a great heated surface, and exposed to the almost immediate action of the fire, in the duplex generators, the steam is generated with immense rapidity; there is no collection or body of water as in a boiler; they occupy but a small space, and consume but little fuel, in proportion to boilers, to produce the same power; the steam may be generated to the greatest height, and the power increased at pleasure, *without danger*."

Remarks by the Patentee.—"In consequence of the small space between the outer and inner tubes or vessels being always preserved, there can be no accumulation of water, the current being constant along the water-line; nor would the diameter of the generators cause any difference in this respect, the water-line being so minute and uniform. The generation of the steam is rapid and instan-

taneous, and no greater quantity of water can be contained in a set of the duplex generators, however numerous, than is contained in the space between the outer and inner tubes, up to the height where the connecting pipes are inserted; whereas, if the steam was generated in open or single vessels, the current of steam and water through them would be destroyed, the water by its own gravity (the pressure of the steam being equal on all sides) would fall to the bottom of the vessels, and of course not act on the upper or most extensive surface of them; by this means they would soon fill with water, and become only boilers at best; a great part of the water would pass into the engine without being turned into steam, and thus clog its operation and decrease its power. The quantity of water injected into the duplex generators may be regulated by a stop cock, placed on the pipe leading to the well, or place from whence the supply of water is obtained; and a cock may be inserted into the lower side of the steamometer, to ascertain whether the pump threw too much water into the generators. The Patentee would remark, that a number of vessels constructed double, and flattened so as to bring the two sides nearly together, leaving a thin space between for a water-line, without any *interior* vessels, and connected together at the ends in a similar manner, leading into a common steamometer, would be the same in *principle*, and produce steam in a similar way; they are not so strong, however, as cylindrical vessels; they are more difficult to connect at the ends, and in the middle would be liable to expand and destroy the effect of the combined rush or current through them. The Patentee would also remark, that the exterior tubes or vessels may be shielded with fire clay, or other material, to render them more durable; and to prevent the destruction of the vessels by oxidation, and also that the interior tube or vessel in the steamometer is not indispensable. In witness whereof, I, the said John Mc Curdy, have hereunto set my hand and seal, this twenty-ninth day of April, in the year of our Lord one thousand eight hundred and twenty-six."

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*Method of Using PURE MURIATE AND SULPHATE OF SODA IN THE MANUFACTURE OF GLASS, by M. Leguay.*—Muriate of soda and sulphate of soda may be employed, and at times with advantage, in glass-making. A casting is readily obtained of very fine glass, having when about three or four lines in thickness, a very slight green tinge. Its composition is as follows:—decrepitated muriate of soda, 100 parts; slaked lime, 100; sand, 140; clippings of glass, of the same quality, from 50 to 200 parts. Sulphate of soda likewise offers a great economy in its employment. The results are very satisfactory. The glass made with this salt was of a very fine quality. The following is the composition: dry sulphate of soda, 100 parts; slaked lime, 12; powdered charcoal, 19; sand, 225; broken glass, from 50 to 200. These proportions give a rich-coloured glass, which may be employed with advantage in glass houses, where a fine quality is sought after. The following is the second way of operating with

sulphate of soda; the proportions may be as follows: dry sulphate of soda, 100 parts; slaked lime, 226; sand, 500; broken glass from 50 to 200. According to this process it is obviously easy to operate in a regular manner, and to avoid expensive trials in the manufacture. — *Annales de l'Industrie Nationale*.

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## JAMES'S PATENTED IMPROVEMENTS IN RAILWAYS AND LOCOMOTIVE CARRIAGES.

It has, we believe, been a generally received opinion, that carriages on a railway cannot be propelled by locomotive power up an inclined plane that rises more than twenty feet in a mile, without the assistance of indented or toothed rails to increase the resistance, and thus prevent the carriages from slipping back. By Mr. James's new improvements, this difficulty is, however, so completely overcome, that a train of carriages may now be made by a locomotive engine to ascend and descend inclined planes of any elevation necessary in the construction of rail roads, and over very smooth and almost polished surfaces. We understand that the most satisfactory proofs have been afforded of the ability to effect this, by repeated trials on a rail road more than a hundred feet in length, laid down for the purpose of experiment; on which it was found that a train of carriages would (with the patentee's improved machinery) ascend inclined planes of 3 inches in the yard, which is equal to 440 feet in the mile. This important advantage is gained by applying the power to the axletrees of the wheels of the several carriages in the train, by means of the rotation of a long horizontal rod (or series of connected rods) actuated by bevil gear under each carriage.

The other improvements are for enabling the carriages on a railway to pass around turns or curves in the road without additional friction. For this purpose, the horizontal rotatory shafts, which causes each pair of wheels in the train to revolve and propel the carriages forward, are connected together by a novel and very ingenious kind of universal joint, which communicates the rotatory motion to each successive carriage, even if so placed on the curves of the roads that the sides of one carriage shall present to the side of the next an angle of 30 degrees. To cause the carriage wheels to run round the curves of the railway without the usual destructive rubbing of their surfaces, the rails in those parts are made with several ribs or elevations, and the wheels of the carriages are consequently formed to correspond with those ribs, by their peripheries being grooved in like manner; so that a wheel, in effect, possesses as many diameters as there are variations in the surface of its periphery, by which means, it may be made to travel faster or slower, as may be desired.

That these consequences result from Mr. James's improvements, will be readily seen on reference to the engravings, which we shall here introduce.

*a* is the boiler of a steam engine, *b* the engine with two cylinders, the alternating motion of the piston in which gives rotation to the crank *c* above; the rods *e e*, attached to the same, being also fixed to the crank of the horizontal shaft *ff* (which passes under the carriages), causes that to revolve with a similar speed to the crank of the engine. Two square boxes. *g g*. are fixed under each carriage; through these the axletrees of each pair of wheels pass; the rotatory

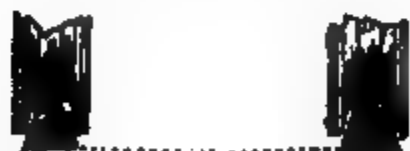
the boxes above the axletrees, and at right angles with them; each of the boxes, *g g*, contain a double bevelled horizontal wheel which presents a circle of cogs in its upper as well as its lower side, and turns upon cross bearings; now the

of the horizontal wheel, while the under circle of teeth of the same actuate a bevelled pinion on the axletree underneath; consequently, compels the wheels to revolve; and the power being thus applied to every pair of wheels simultaneously, sufficient resistance is obtained, on a smooth surface, to ascend inclined planes of considerable elevation. *www* are the universal joints, which communicate rotatory motion when the carriages are not in a straight line: these and other moving parts are distinctly shewn in the annexed figure, which is upon a larger scale.

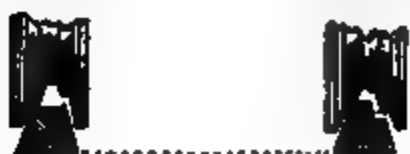
*ff* is the rotatory shaft; *g g* the two boxes, with the front plates removed to shew the gear inside; *h h* the bevelled pinions upon the shaft in each box; *i i* the horizontal double bevelled wheels. The front box, *g*, under the carriage, is fixed immoveably to a solid block of wood; the other box is fixed to a plate *l*, turning on a central point, which passes through another plate, *m*, above, the plate *m* being secured to the floor of the carriage by hinge joints, *n n*. The construction of the universal joints, *u u*, are also more clearly shewn in this figure.

We have now to describe the highly ingenious contrivances by which the patentee obviates the destructive effects of the rubbing or sliding of the inner wheels of carriages in making curves or turns in a round; contrivances that at first sight may appear simple and unimportant, but which, in our opinion, evince a considerable degree of skill in the inventor.

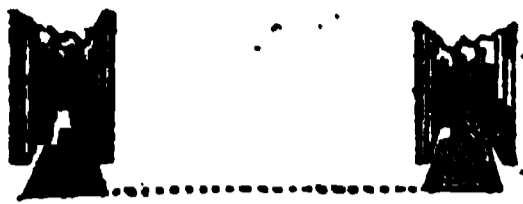
Our readers need not be informed, that if the wheels on one side of a carriage be larger, or of greater diameter, than those on the opposite side, such carriage, when propelled, will necessarily make a curve. On this principle the patentee's contrivances are founded. In running along a straight line the peripheries of the wheels are of equal diameter, and the bearing upon the rails are of equal elevation; but when the carriage has to make a turn, the wheels on one side roll upon a greater diameter, or more extended periphery; while the wheels on the opposite side run on a less extended periphery, and the elevations upon the rails upon which they run are so adjusted to these variations, that the different peripheries of the wheels change, and come in contact with the variable parts of the rail, and run round the curves, without any perceptible increase of friction, or jarring, or jolting. The annexed diagrams are in illustration of this part of the patentee's improvements.



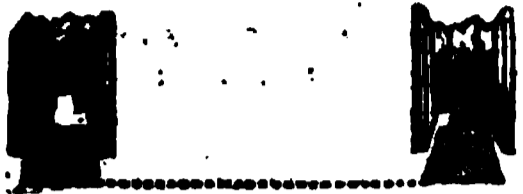
In this figure, the carriage wheels are supposed to be running in a straight line, consequently the peripheries are equal, and the bearings of the rail equal.



In this figure, the wheels are supposed to be making a curve equal to an increase of half an inch in a yard on the outer line or track.



In this, the wheels and other parts are adapted to make a turn, where the curve makes a difference in the two lines of two-thirds of an inch in the yard.



In this, a curve wherein the difference is one inch.

It is calculated that the following advantages will result from these improvements, viz.

A saving will be effected in the principal part of the cuttings, embankments, viaducts, &c., and a saving of full four-fifths of the time requisite for making the road. In saving the land lost in deep cutting, and the slopes of the embankments; and in shortening the distance, in consequence of the engine and loaded carriages being able to pass over elevated ground. Owing to the resistance at each individual carriage, the engine carriage may be reduced full one-third in weight, therefore a greater load may be propelled by the same power. In saving the primary and current expenses of fixed engines, wherein the power applied is always the same, whether the traffic upon the rail requires it or not, and in avoiding the delay consequent upon their employment; whereas, in locomotive engines the power may always be adapted to the trade or load. In affording the opportunity of passing over or under turnpike roads, &c. by which much of the objections raised against railways in populous districts is obviated; and the facility with which obstacles in private property may be avoided. In enabling the engine and train of carriages to be suddenly stopped, whether on level ground or in descending hills. Likewise reducing the liability to breakage or accident in stopping such carriages, in consequence of the number of parts to resist a sudden impulse.

Railroads of the usual construction soon get out of order by wearing at the turns, and in the settling of the ground in new embankments, which will be wholly prevented by the present improvements. There being no deep cuttings and embankments, property in land will not be divided by them, as in ordinary cases. By means of the joints (before mentioned) under each of the carriages, a nearly equal bearing of each wheel is effected, if the surface of the rails should be uneven, so as to cause the axles to stand at different angles. A considerable saving, it is considered, will likewise be made in the tonnage and interest of the capital expended, and in completing the rail in much less time than usual; also in the facility and little expense attending the making alterations in the rail after completion.



**History of the Steam Engine.****CHAPTER III.**

**CONTENTS.—DEFECTS OF BOLTON AND WATT'S ENGINE.—FRICTION—RECIPRO-  
CATION—POWER OF THE CRANK—NO POWER LOST THEREBY—IRREGULAR  
WEAR OF THE PISTON ROD AND CYLINDER.—DISADVANTAGES ATTENDING  
THE USE OF TWO ENGINES WITH THE CRANKS AT RIGHT ANGLES WITH EACH  
OTHER.**

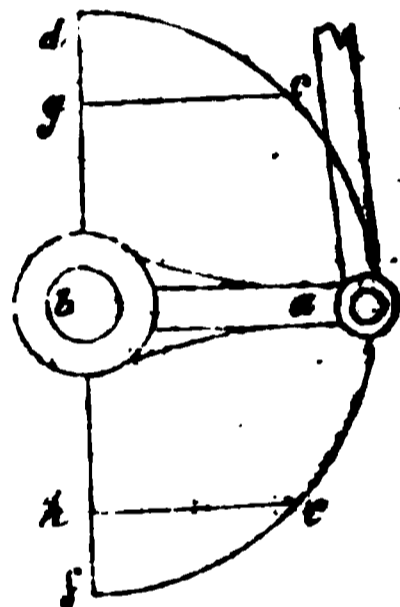
We now come to speak of the imperfections attendant on the Bolton and Watt engine: these are, friction from the rubbing of the moving parts against each other—the reciprocation of the machinery, and the irregularity of the motion: we shall notice them successively. 1st, The rubbing of the parts against each other.—This evil must exist in every conceivable form into which the steam engine may be modified, but no doubt the quantity may be considerably reduced. The steam, in order that we may have its full effect, acts against a moveable piston in a cylinder from which it cannot escape. This piston is, as has been explained, packed or stuffed on its edges, which prevents the steam from escaping past it; and from the nature of the material used for packing, and the tightness with which it is pressed against the cylinder the friction arises. This is sometimes so great that we have seen engines where the whole force of the steam could not give them motion. It is usually estimated at one third of the power of the steam—that is to say, if the steam acted upon a piston with a force of 1500 lbs., the effect produced would not exceed 1000 lbs., a power of 500 lbs. having been absorbed by the movement of the machinery alone.

The next objection is the reciprocation of the parts. This is an evil of considerable magnitude. It originates from an inherent law in matter by which all bodies have a tendency to continue in the motion communicated to them, or remain in their natural state of rest. If a cannon ball be discharged from the mouth of a cannon, it requires an exertion of force to give it an impetus greater than would be required to continue its motion. If its progress be arrested whilst in motion a shock will be experienced by the body which impedes it, the force of which shock will vary as the velocity of the ball. When this ball ceases to move without any *visible* impediment it is not that its original impetus is exhausted or spent, (though the latter term is frequently used) but that it is gradually overcome by the particles of air which form a succession of points of resistance upon which its force is nearly destroyed, and it is then drawn down to the earth by the superior attraction of gravitation. If we could destroy the intermediate resistance of the air the ball would continue in motion for ever, because nothing would intervene to destroy the primary impetus. This property of matter occasions a considerable destruction of power in the steam engine. The motion of a massive beam, and its necessary appendages of machinery, a piston, connecting rod, parallel motion, and pump buckets, have to be reversed at each stroke of the engine, and that too when the speed is very great. The natural state of rest, or *vis inertiae*, i. e. the force of inactivity, has to be overcome at the commencement of each stroke, and when a great velocity is acquired

it is as suddenly checked to prepare for the returning one. This necessarily produces a great strain upon the machinery, which must be made proportionably more massive: and it requires likewise great skill in the construction of the engine house to prevent its being ultimately destroyed by the alternate push and pull which it experiences at each reversion of the beam. We have repeatedly noticed the best constructed engine houses shaken, and almost falling to pieces from this cause.

Various schemes have been proposed to remedy one of the evils of reciprocation. We mean the shock experienced by the reversion of the matter. It is not expected to prevent the loss of power sustained thereby; for that must remain as long as the law of which we have just spoken exists. Where a crank and fly wheel are used to obtain a rotatory motion a *shock* is prevented by the velocity being gradually retarded, the crank having to perform a greater portion of its revolution with only the same surface of steam at the commencement and termination of each stroke of the piston: we explain our meaning by reference to the marginal diagram.

$a b$  is the crank of a steam engine, of which the semi-circle,  $d, c, a, c, f$ , represents the motion communicated by one stroke of the piston; when, therefore, the crank in its present position is moved from  $a$  to  $c$ , the piston is at its greatest speed, and travels nearly at the same velocity as the point  $a$  of the crank. But when moving from  $c$  to  $d$ , an equal piston of a revolution, the piston only moves a distance equal to  $g d$ , in the same space of time, as it had previously moved a distance equal to  $b g$ , almost double of  $d g$ .



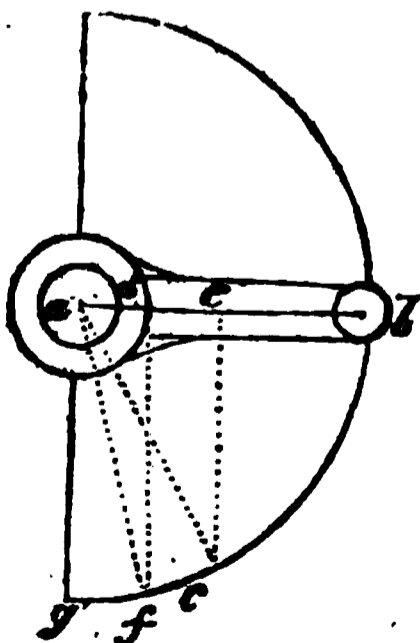
Hence it appears that the crank, by gradually decreasing the speed, is admirably adapted for preventing the violent shock which would otherwise be experienced by the piston striking the top and bottom of the cylinder, and by changing the motion of the beam too suddenly, but it does nothing towards reducing the power lost by reciprocation. In pumping engines, where a fly wheel and crank are not used, other means are adopted to check the force of the piston, or guard against the shock of suddenly changing the motion of the beam. In the coal districts the usual way is to shut off the steam when about two thirds of a stroke has been performed; the expansive force of that already in the cylinder, together with the impetus of the piston sufficing to barely carry it to the termination without violence. In such engines springs are sometimes fixed above and below the beam, so as to check its progress should the steam possess more force than may be expected. "It once happened," says Mr. Farey, "that the valve of the pump bucket breaking, the engine suddenly lost its load or resistance, which occasioned the piston to descend and strike on the spring beams for two or three successive strokes with such violence as to break one of the beams, and at last the piston striking the bottom of the cylinder, the momentum of the beam forced down upon the rod so violently as to bend the great piston rod quite

crooked. To prevent similar accidents, a smaller steam pipe was added to the side of the vertical steam pipe communicating with the passage into the bottom of the cylinder. This pipe is kept closed by a valve; but if the engine descends so low as to strike on the spring beam, a catch pin on the beam strikes a small lever, and by a wire of communication opens the valve and lets the steam into the lower part of the cylinder beneath the piston and thus destroys the vacuum, so as to prevent the further descent of the piston."

This addition, it will be understood, applied only to the single acting engine, but it serves to shew that the objections we have given arising from momentum are not merely theoretical.

The beautiful addition of the crank to the steam engine, although the means of extending its utility tenfold has been the subject of much objection. Engineers and others possessing considerable claims to the character of scientific men, have not unfrequently maintained that there is a considerable loss of power by the change in the length of the lever as the crank revolves. We shall endeavour to show the error into which such persons have fallen.

The principle of the lever is so well known, that it is scarcely necessary to explain it: lest, however, it should not present itself to all our readers, we shall give a short description. "In all levers the universal property is, that the effect of either the weight or the power, to turn the lever about the fulcrum, is directly as its intensity and its distance from the prop; whence it is deduced, that if parallel forces acting perpendicularly upon a straight lever keep it in equilibrium, they will be to each other reciprocally, as the distances from the fulcrum upon which they act." \* Thus, supposing a bar of four feet in length be fixed upon a fulcrum exactly in the middle, and an ounce weight be suspended at each end, the two ends will be in equilibrium, because the force of gravitation is equal, neither possessing it in a greater degree; but if the fulcrum be shifted and placed three feet from one end, then it will require three ounces at the shorter end to balance one ounce at the other. If motion be given to the shorter end whilst the fulcrum remains the same, the end of the longer lever will traverse three times the space of the shorter.

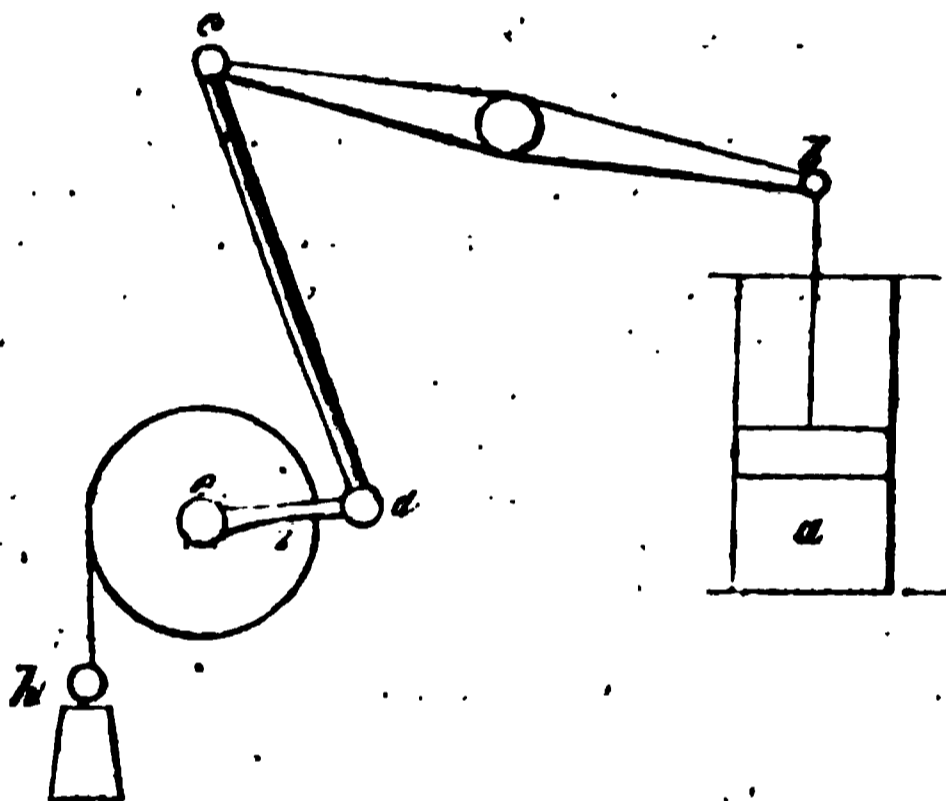


The crank of a steam engine is a lever whose fulcrum is at *a*. It is the nature of the crank that its power or leverage varies with its position. Let *a b* represent the crank, the point *b* is moved by the connecting rod, and revolves round the centre *a*. Supposing the resistance be equal to 100 lbs. or that 100 lbs. have to be raised 3.1416 feet for every revolution of the crank: it is evident if a force or weight exceeding 100 lbs. be applied at *b*, whilst the crank is horizontal, it will be sufficient to raise the weight. But when the point *b* has descended to *c*, the length of the lever being described by its sine, the vertical line, *e c*, drawn through

\* Good and Gregory.

$a b$ , shews  $c a$  to be the length of the lever, which is only one half of  $b a$ . It would, therefore, require a weight double of the former to continue the motion. And if the crank descend to  $f$ , the vertical line,  $d f$ , shews  $d a$  to be the length of the lever, and to be only one fourth of what it was when horizontal. When it reaches  $g$  no power on earth applied through the medium of the connecting rod, would further continue the motion.

To equalise this irregularity, and in some degree to compensate this great variation, the cylinder is of such dimensions as to give out a considerably greater power when the crank is horizontal than is then necessary. This extra power is employed to give motion to the fly wheel, which is of sufficient dimensions to retain the impetus until it is past the point  $d$ , when the steam begins to act with effect upon the lower side of the piston.

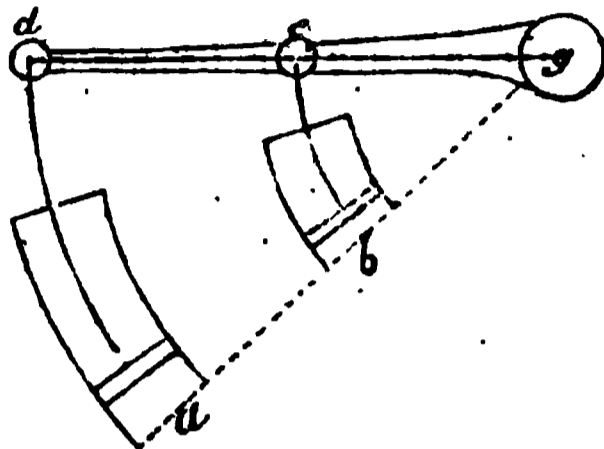


Let  $a$  represent a cylinder, the length of the stroke of the piston being two feet.  $d e$  is the crank, the length of which is one foot;  $b c$ , the beam, the fulcrum of which is exactly in the middle. If the piston be put in motion the extreme end of the crank will describe a semi-circle of 3.1416 feet. Now let us suppose that a drum be fixed upon the axle  $e$ , whose circumference is four feet, equal to one ascending and one descending stroke of the piston. If a weight be suspended by a rope to this drum, as at  $h$ ; the power of the engine at that point will exceed the power necessary to raise the weight as much as  $d e$  exceeds  $i e$ . This extra power is communicated to the fly wheel, which faithfully gives it out when required. When the crank has descended so as to decrease the length of the lever, that it is shorter than  $i e$ , then a portion of the extra power in the fly wheel is destroyed in aiding the decreased leverage of the crank. And although the power gradually decreases, yet the speed of the piston gradually decreases also, so that if the power of the crank be only one half in a certain position, yet the quantity of steam used is only one half, and thus the effect of no part of the steam is wasted,

the effect being in every point equal to the steam expended. It is true that if we could have applied the power at a point equidistant from the centre in every part of the revolution, we should have obtained much greater leverage, but then the expenditure of the steam would have been proportionably greater.

We will further explain this theory by referring to another diagram.

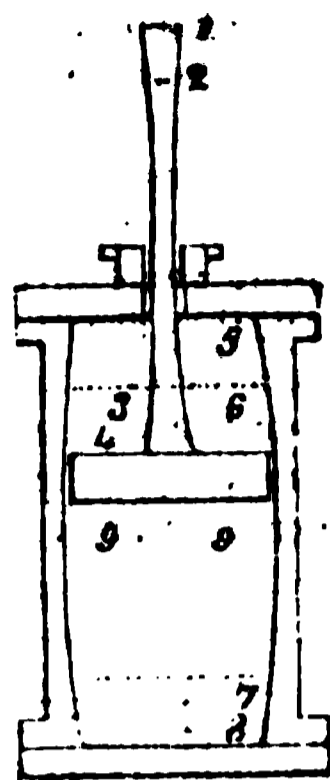
$g d$  represents a lever like the crank:  $g$  being the axle.  $a b$  are two vessels fitted with pistons, and in every respect resembling cylinders, excepting that they are curved so as to describe portions of circles formed from the point  $g$ . We will suppose that the piston in  $a$  acts upon the extremity of the crank, and that in  $b$ , at half the distance from the centre. The



vessels are of the same area, so that if steam were introduced from a boiler, it would press with equal force upon each piston, and consequently the rods would each press with an equal force upon the points,  $e d$ . Now it would be maintained that, because at  $e$  there is only half the leverage, therefore half the effect of the steam in  $b$  is lost; but it will be found, that if that lever,  $g d$ , be moved any given distance round its centre, that the piston,  $b$ , only moves half the distance of the piston,  $a$ ; and consequently, the areas being equal, and the distance but one half, only half the steam is expended. Hence it is clear, that the consumption of the steam in every point of the lever is only equal to the effect produced.

There are minor objections against Watt's engine which, nevertheless, should be noticed. One is the waste of steam at the reversion of the motion of the piston. First, from the pipes between the valve and the cylinder. In filling the cylinder these must be filled, and in discharging, these must likewise be emptied; so that they are filled and emptied at each change of the motion. But in the cylinder every particle of the steam produces an effect: whilst here the steam used produces no effect, and is therefore wasted. Secondly, From the changing of the valves themselves at the improper time. It may indeed be said, there is no proper time to change the valves, because there is no time at which they can be changed without disadvantage by loss of steam; and the difficulty of determining the precise time frequently occasions their being changed at such a time as to waste more steam than is unavoidable. The necessary waste arises from the change of the valves being a work of time, whilst the reversion of the stroke is instantaneous: therefore, either the change of valves begins too soon, and admits steam into the vacuum before the stroke is completed, or ends too late, and admits steam into that part of the cylinder when a vacuum is forming, thereby preventing its formation; or otherwise it is attended with both these disadvantages. The improvements in the valves, we are sorry to say, have but increased this difficulty, and which we shall notice in their proper place.

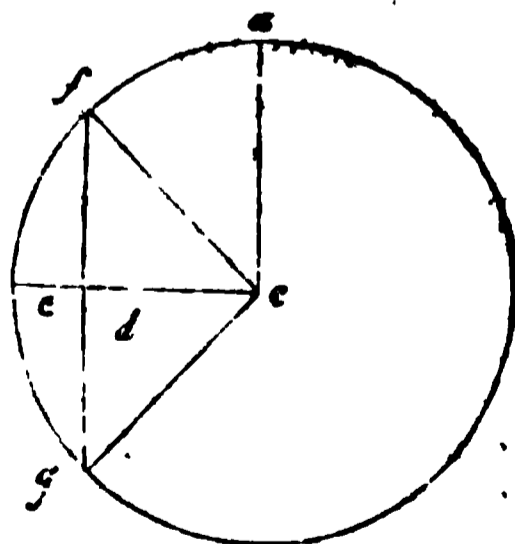
Another disadvantage is the unequal form into which the cylinder and piston rod become worn after having been some years in use. This arises from the varied speed at which they travel, and to their not passing over all parts of the surface. We have seen a piston rod in use full as much out of form as that in the drawing, and cylinders nearly so. The form of the piston rod arises from the parts 1, 2, and 3, 4, being only partially drawn through the stuffing box, consequently less rubbed than the middle, which is drawn through at each stroke. The decreased diameter in the middle of the rod arises from the speed being greater there than at other parts, (the cause of which we have explained) and creates in consequence a greater wear.



The irregular wear of the cylinder is produced in the same manner. The piston is not drawn through, but merely comes in contact, or is partially moved through 5, 6, and 7, 8, whilst it rapidly passes the middle, and therefore, in that part, it is more worn than at any other.

The last inconvenience we shall notice, though it is by no means the least, is, that the fly wheel is the constant and indispensable accompaniment of the crank. This will appear evident from what we have already stated.

Independent of extra cost, extra friction, and extra room, it becomes necessary to have two engines in steam boats, to obtain any thing like a regular motion, and even this is far from regular. In steam boats the two cranks are fixed upon the same axle as that on which the paddles are placed. By this contrivance, when the crank of one engine is passing the centre and has no power, the other is at its greatest power, and thus aiding each other, something like an equality is preserved: but this is irregular, as a variation still takes place in the mean length of the two levers.  $ac$ , and  $cb$ , represent two cranks, the axle of which is  $c$ .  $ac$  is now passing the centre, and therefore has no power, whilst the other,  $cb$ , is at its greatest power. The mean length of the lever, therefore, is at  $d$ , or one half of  $cb$ ; but when the two cranks have made one eighth of a revolution, as to  $cf$ , and  $cg$ , then the line,  $fg$ , shews the mean power to be at  $e$ ; having varied from  $cd$  to  $ce$ :—



This irregularity being unaided by a fly wheel may probably account for the vibration which we feel in many steam boats, and which appears to proceed from some other cause than the reciprocation of the parts. It should be observed that the impetus of the boat makes the paddles act as a kind of fly wheel, because if they were suddenly

disengaged from the machinery they would continue to revolve of themselves so long as the velocity of the stream was less than the velocity of the boat, because then the stream acts like the current for an undershot wheel. So long as the vanes continued to be driven against the water, so long would the motion of the wheels be continued in the same direction as that given by the machinery; therefore we say, they are fly wheels of a peculiar kind; but still as the speed would immediately decrease as they were disengaged from the machinery, from the yielding nature of the medium through which they pass, so also would they vary in velocity as the mean power of the crank increases or diminishes.

[To be continued.]

### MESSRS. LEDSAM AND COOK'S PATENT,

FOR THE PURIFICATION OF COAL GAS.

THE improvements contemplated by the patentees, (Messrs. J. F. Ledsam, and Benjamin Cook, of Birmingham) consist in the employment of common salt, and certain metals in solution, for the purification of coal gas, in preference to lime and other earthy substances heretofore employed for the same purpose; the following are the processes described in the specification:

Muriate of soda, or common salt is to be placed in alternate strata with the coal in the retort; or the salt may be mixed with the coal previous to subjecting it to distillation; by either of these means it is said, that the gas as it is generated or emitted from the coals, will be immediately purified. The quantity of salt required will vary according to the nature of the coal; the quality of the salt is immaterial, the refuse taken from the bottoms of the pans in the salt works, answering the purpose effectually.

Another method is to pass the coal gas generated in the ordinary way, through several layers of dry salt in a distinct vessel or chamber.

A third method is to pass the gas through a solution of common salt in water.

A fourth, to pass the gas through a solution of silver, copper, iron, zinc, or other metal, in nitric, or other acid.

A fifth, is to combine two or more of the above processes in the purification of coal gas.

### TO OUR READERS.

**EVE'S NEW STEAM ENGINE.** We are happy to have it in our power to announce that a full Description of Mr. Eve's New Patent Steam Engine will appear in our next.

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**EVE'S PATENT  
IMPROVEMENTS IN STEAM ENGINES.**

## SPECIFICATION OF THE PATENT

RECENTLY GRANTED TO JOSEPH EVE, LATE OF THE UNITED STATES,  
BUT NOW OF LIVERPOOL,

## FOR IMPROVEMENTS IN STEAM ENGINES.

SINCE the first notice of Mr. Eve's improved Steam Engine, which appeared in the Liverpool Courier, in December last, we have been solicitous to lay a description of it before our readers; it is, therefore, with peculiar satisfaction that we are now enabled to submit a full account of this ingenious and interesting invention to their consideration.

As, however, the introduction of the whole specification, and all the illustrations, into one single number, would occupy so large a space, as to preclude the insertion of other matters of interest, we shall divide it into two parts.

"To all to whom these presents shall come, &c. &c. Now know ye, that in compliance with the said proviso, I, the said Joseph Eve, do hereby declare, that the nature of my said improved steam engine consists of five particulars.—1st. In the application of revolving cones to rotary engines, in the manner hereinafter described, for the purpose of compensating any loss by friction, and in the general arrangement of the various parts of the rotary engine hereinafter described.—2nd. In a steam generator so constructed of tubes, that the heat of the furnace shall cause the water to circulate constantly through the tubes, thereby preventing the steam from driving the water out of them, by which means the said tubes are less liable to burn out, or become oxidated.—3rd. In an arrangement of one or more revolving cock or cocks for the purpose of supplying the generator with water in lieu of the ordinary forcing pump.—4th. In a new safety apparatus, by which the elasticity of steam in boilers is ascertained by weights directly applied, instead of indirectly, as in the ordinary steel yard valve.—And 5th. In an arrangement of cog-wheels with a compound engine, in such manner, that the steam, after having acted as high pressure, may be used as low pressure with greater effect, than in any engine now in use; and in further compliance with the said proviso, I, the said Joseph Eve, do hereby describe the manner in which my said invention is to be performed, by the following mechanical description of the various improvements constituting the same, reference being had to the annexed engraved figures, and letters marked thereon, which illustrate three modes of constructing my rotary steam engine.

"Fig. 1 presents an end section, *fig. 2* a longitudinal section of the said engine on the simplest manner of construction. The same letters refer to similar parts in all the figures.

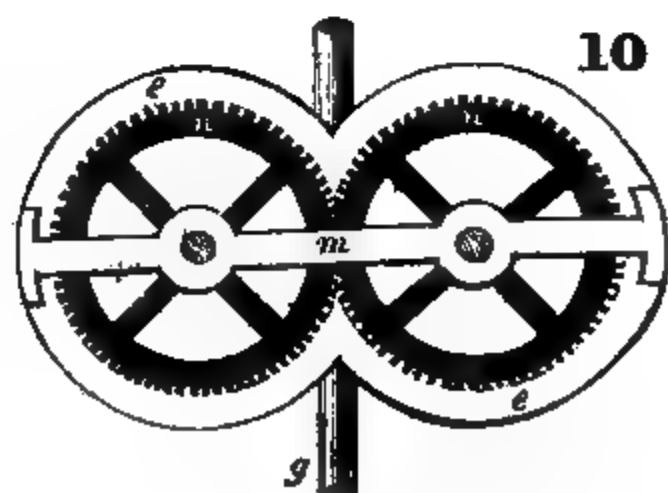
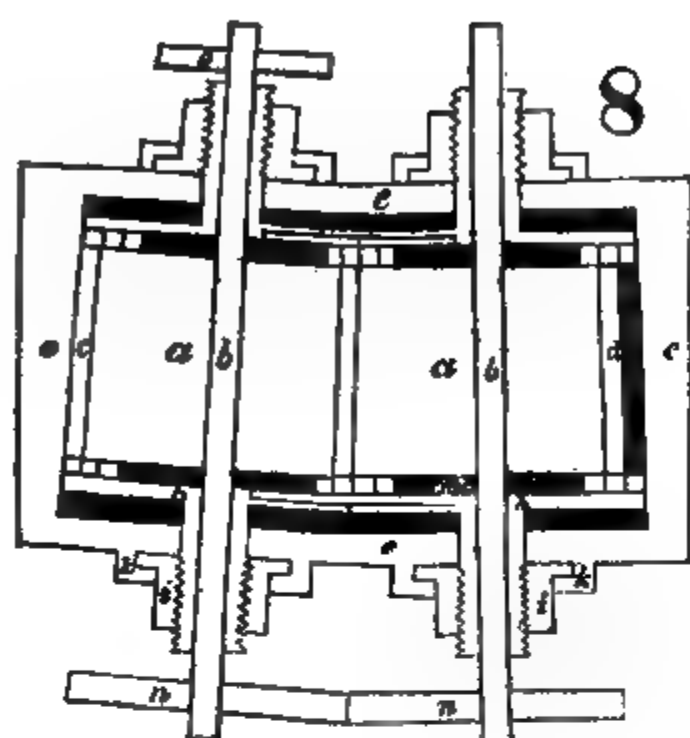
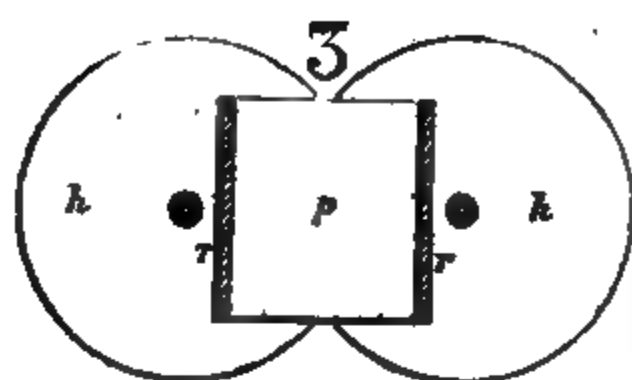
"*a a* are the cylinder and cone revolving in contact in opposite directions, the cone having one groove and being one third of the diameter of the cylinder, which latter has three wings or pistons *c c c*, the ends of which as they revolve, touch the outer case *e*, and do not admit any steam to pass. The steam is admitted through

the pipe *f*, and acting on the wing *c*, causes the cylinder to revolve until the said wing passes the pipe *g*, when the stratum of steam lodged between each two wings, is allowed to escape. The wing, which has thus passed, falls into the groove *d* of the cone, the bottom of which groove it touches in passing, thus allowing no steam to escape between. The said wing *c* then passes again by the steam pipe *f*, and is acted upon as before described, and so on in rotation. The cylinder *a*, which is firmly fixed to its axis *b*, rests on one side on the outer case *e*, through which the axis projects, but as there is some friction produced by the revolution of the said cylinder at its two ends touching the outer case, I have placed a false end *h h* under the opposite end of the cylinder, which false end slides on the axis *b* freely, and has a thread cut at the end, by means of which and the adjusting nut *i*, the cylinder, if worn at the two ends, can be easily tightened and adjusted. The adjusting nut is confined by the collar *k*, which collar is screwed to the outer case. The conical shape of the small runner, which can likewise be moved upwards or downwards in the outer case, serves to keep the two convex surfaces of the cylinder and cone in contact, so that no steam can escape between them. It is obvious from the conical shape of the runner, that, the longer the engine will be in use, the better it will work, and the more steam tight it will become.

“ The groove *d* in the conical runner is cut into a separate piece of metal, which slides by an adjusting screw *o* up and down, so that when the engine is adjusted, the groove *d*, on the piece of metal, into which the said groove is cut, can be moved up and down, so as to fit the wings of the cylinder.

“ Letters *n n* in fig. 2 present two cog-wheels running into each other, attached on the outside of the engine to the axis of the cylinder and cone, placed there for the purpose of producing a corresponding revolution of the said cylinder and cone, thus causing the groove of the cone to present itself regularly to the wings of the cylinder; *o* is a pinion fixed to the other end of the axis, by means of which any machinery can be put into motion.

“ Another variety of constituting a steam engine on my principle is shewn by an end section view in fig. 5, and an external view in fig. 6. This engine has a cylinder with two small conical runners on each side, the said conical runners being of the same construction as before described, with one groove cut into each, and being one third of the diameter of the cylinder. There are two induction and two eduction steam pipes, and, although the engine may be, with the exception of the addition of one of the conical runners, exactly of the same size as the one first described, a double quantity of steam is requisite, and twice the power of the former engine is gained: the steam enters through pipe *f a*, and acts on the wing *c*, which after having passed pipe *g o* where the steam escapes, falls into the groove *d* of the lower cone, and appearing at the induction steam pipe *f b*, is loaded again with steam pressure, which it discharges at the second eduction pipe *g o*, and then enters the groove of the upper cone, after having passed which, it is loaded again at the first mentioned induction pipe. c 2



“ Letters *m m* are bridges, by which the spindles on axis *b b b* are supported. This engine has three cog-wheels *n n n* attached to the three spindles, so as to cause the cylinder and cones to revolve in unison, and like the first described engine, a pinion *o* on the opposite end of the axis of the cylinder. *Fig. 7* shews an end section; *fig. 8* a longitudinal section; and *figs. 9, 10, 11*, external views of an engine, which I have constructed upon a different plan, without altering any of the leading principles of the two engines heretofore described.

“ The same letters already explained apply likewise to the last mentioned figures. The two conical runners in this engine are of an equal length and diameter, each has two wings or pistons attached, and two grooves cut into it, and in revolving in opposite directions, the wing of one runner falls alternately into the groove of the other. The steam enters by pipe *f* and as the cylinders are running in contact, it cannot escape between them, but acts upon the two wings in opposite directions, and escapes at the eduction pipe *g*, after the said wings have passed the same. By reference to *fig. 8* which represents a longitudinal section, it will be seen, that the two cones have each two false ends *p p*, sliding freely on their spindles; the two outer cases *e e* fit over the runners and their wings exactly, each of the four false ends has an adjusting nut by which the engine is tightened if steam should escape, or slackened if it should run too tight. Each pair of the false ends, where they join, have a plate that connects them and breaks their joints, so as to prevent escape of steam, this plate *p* slides into the groove *r* cut out of the false ends, as exhibited by *fig. 3*, and *fig. 4*, the former shewing an end view of the false ends with the connecting plate in the middle. On these false ends, packing rings *g g g* which are confined to the sliding plate as exhibited in the latter figure, are placed. These rings press against the hollow outer cases and prevent any steam escaping by them. These packing rings are shewn in section, in *fig. 8*. It will be evident, that the false ends need not be made true, if the connecting plates and packing rings as above described, are adopted, and that the engine, if provided with moveable false ends, conical runners, and the afore described connecting plates, and packing rings attached, as shewn in *fig. 8*, can always be kept steam-tight, and by use, the various parts on which there is any friction, will fit better.”

The preceding extracts from the specification are the whole that relate to the patentee's improved rotatory steam engines, considered distinctively; we accordingly here add the observations of the patentee on this part of the subject.

“ The simplicity of the principle of this engine, in all its details, is sufficiently apparent on inspecting the annexed diagrams. There are no reciprocating parts, levers, fly-wheels, nor valves, but simply two revolving parts, and if I may so speak, the whole power of the steam is appropriated by the direct or first intention.

“ The relative weight and bulk of this engine will require a few more words for elucidation. A more concentrated power in steam engines is attainable in two ways: the first is by using steam of great

elasticity ; thus on Mr. Perkins's plan, a cylinder two inches in diameter would be sufficient for a ten horse power : the second method of diminishing the dimensions of steam engines is to increase their mobility, that is, to give greater velocity to the part or parts on which the steam acts ; this, in all engines having reciprocating motions, is limited ; for motion, alternately in opposite directions, requires a certain time, otherwise the whole power of the engine may be consumed by simply overcoming the inertia.

“ Now it is certain, abstractedly considered, that as we increase the velocity of the piston, we may decrease the size of the engine ; it follows, therefore, from the above premises that, if we could conveniently make use of steam of 150lbs. to the inch instead of mere atmospheric pressure, and have 150 strokes to the same engine instead of 15, we should acquire 100 times the power ; or, what is the object at issue, have the same power with an engine and generator in that proportion smaller. The first object, as regards high pressure, it will not be too much to concede ; as it has been, long ago, practically attained by Evans, and others. And, as to the velocity which this engine is calculated to admit of from its construction, though not unlimited, it is certainly very great, much more than ten times that of reciprocating engines, and much greater even than that of rotary engines that have reciprocating parts : thus, if these premises be correct, it cannot be too much to say that this engine ought to have the same power as the engines in common use, though of smaller dimensions ; and that the weight will be reduced, not in proportion to the reduction of its superficial, but its cubic dimensions.

“ As a result, the expense of erecting an engine of a given power, on the construction of the above, ought to bear a proportion to the diminution of its bulk and weight, and greater simplicity.”

Our next week's number will conclude the specification, embracing a description of a novel and ingenious apparatus for the generation of steam, added to which is a substitute for the forcing pump, (now universally employed) by which the generator is constantly supplied, without attendance, with the exact quantity of water required to replenish it, as the steam passes off : also, a safety apparatus, and other new mechanical arrangements, the whole of which will be clearly illustrated by engravings.

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### COOK'S PATENT LIFE PRESERVER FOR CARRIAGES.

We are not acquainted with the mechanical arrangements of this invention, but as it appears to be at present applied to a variety of wheel carriages, and may be seen in action at the Manufactory, No. 127, Long Acre, we do not hesitate to give insertion to the following statement of its uses and advantages, which we gather from a circular sent to us of the Patentee's.

Its object is to stop horses, when running away with the vehicle to which it may be attached. The contrivance is so extremely simple, that a lady or a child may, with the greatest facility, apply its force against the power of the horses, thereby gradually and irresistibly arresting their progress, until the strain is off the traces ; when

it will of itself cease to act, further than by retaining them in their then position, until the driver thinks fit to release them, which he can do in an instant without quitting his seat. Should the coachman require to leave the box, this invention will enable him readily and most effectually to prevent the possibility of the horses starting off in his absence; or should he be thrown from his seat, or fall off in a fit, or from any other cause: a lady in her carriage, has the power of stopping a pair, or four horses, with ease and with certainty. Four horses can be pulled in as easily as one; as they are literally stopped by their own power.

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### PROCESS FOR OBTAINING SODA FROM THE SULPHATE OF SODA.

THIS process, which was lately the subject of a French patent, or brevet d'invention, appears to be deserving the attention of our soda manufacturers.

Let lime or chalk be dissolved in pyroligneous acid; the oil which results and floats on the surface may then be taken off. When the acid is thus saturated with lime, the sulphate of soda may be added, the quantity of which will be according to the degree of concentration of the calcareous solution, which may be determined by an acrometer for salts. By superior affinity, the sulphuric acid quits the soda, and forms with the lime a solid salt, (sulphate of lime) which precipitates to the bottom of the vessel. The supernatant liquid being evaporated yields the acetate of soda; if this salt is not in request, it may be exposed to the heat of a furnace, when carbonate of soda will result; this being dissolved in a hot ley, will, on cooling, yield crystals of great purity.

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### BUTLER'S PATENT COFFINS.

THIS invention appears to be a very ingenious method of preventing bodies from being removed from coffins after burial. The interior of the coffin is to be lined or bound with ribs or plates of iron, through which at the lower part of the coffin, inside of it, holes are to be made and tapped with screw threads; the lid being placed on, long screws are passed through it which enter the tapped hole at bottom. These screws are not made with a cut or slit in the head to be turned by a common screw driver, but they are tapped on the head "with an original screw," and a winch is employed to turn the screws in, which has a hollow original screw to correspond with that on the head of the long screw, and to fit it accurately. The long screws are turned down upon their bearings until their tapped heads are sunk below the surfaces of an iron plate through which they pass, to prevent their being taken hold of; and their heads are case hardened to prevent their being cut, to be operated upon by a screw driver: so that it becomes necessary, for the person who attempts to extract a body, so secured, to be in possession of the original instrument, by which the screws were turned in, in order to turn them out again.

## History of the Steam Engine.

### CHAPTER III. *continued.*

#### *Contents.*—WATT'S ROTATORY ENGINE.

It will be readily conceived that these disadvantages must have exercised the talent of many ingenious men. All have agreed that the remedy might be found in a circular or rotatory motion, obtained from the steam itself, without the aid of the beam, crank, or piston rod. That if this could be effectually done, it would do away with almost every defect of which we have spoken. Reciprocation would be removed, as well as irregularity in the power of the lever: and as for friction, that of the beam and appendages would, at all events, be destroyed: but it has been found that, hitherto, notwithstanding the advantages attendant on this kind of engine, inconveniences and difficulties have been found, peculiar to each varied form, or common to all that have precluded its adoption in preference to the reciprocating engine. The defect in many of them has been excessive friction, and, in nearly all, the difficulty of maintaining the packing steam tight: this is as much as we can say as to the general objection. We shall direct the attention of the reader to several of the best rotatory engines, and endeavour separately to shew the causes of failure.

The shrewd and investigating mind of Watt seems to have directed itself in the very outset of his career, to the desirableness of such an engine: for we find in his patent of 1769, (the specification of which we have examined,) that a rotative engine is one of the inventions included therein, and seems to claim precedence in his judgment (if we may judge by the order in which they stand) to the use of hemp and oil in packing, instead of water as in the old engines.

We will extract that part of the specification verbatim.—

“Where motions round an axis are required, I make the steam vessels in form of hollow rings, or circular channels, with proper inlets and outlets for the steam, mounted on horizontal axes like the wheels of a water-mill. Within them are placed a number of valves, that suffer any body to go round the channel in one direction only: in these steam vessels are placed weights, so fitted to them, as entirely to fill up a part or portion of their channels, yet rendered capable of moving freely in them, by the means hereinafter mentioned or specified. When the steam is admitted in these engines, between these weights and the valves, it acts equally on both, so as to raise the weight to one side of the wheel, and by the reaction on the valves successively, to give a circular motion to the wheel; the valves opening in the direction in which the weights are pressed, but not on the contrary. As the steam vessel moves round, it is supplied with steam from the boiler, and that which has performed its office may either be discharged by means of condensers, or into the open air.”

There is a great deal of confusion and ambiguity in this part of the specification, as, indeed, there is throughout, so much so, that

we are surprised that the patent was ever sustained, since it is required that all specifications should be so clear, "that a person of moderate capacity, having a little knowledge of the science which led to the invention, can immediately see the method pointed out, and easily apprehend the purport for which the subject was invented, *without study*, without any invention of his own, and without experiments. \*'" No drawings are given of any one of the six inventions included in this patent, and the reader may judge by this specimen whether any one can comprehend it without study. After much study we have been able to come at the meaning of the patentee, by supplying the form of the valves, and indeed, most of the principle parts, and in that form we submit it to our readers as

### THE FIRST ROTATORY ENGINE.

In explaining its principle we shall repeat the words of the specification, making such alterations in the language as may make it understood.

"Where motions round an axis are required, I make the steam vessels in the form of hollow rings, or circular channels, with proper inlets and outlets for the steam" (as at *a* and *b*), "mounted on horizontal axes" (*c*), "like the wheels of a water mill. Within the circular channel" (*d d'*) "is placed a number of valves" (*e e e e*) "that suffer any body to go round the channel in one direction only:

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\* Godson on Patents, p. 400.

in each steam vessel is placed a weight" (*f*), "so fitted to it" (by packing at *g*) "as entirely to fill up a part or portion of its channel; yet rendered capable of moving freely in it by means hereinafter mentioned. When the steam is admitted between the *weight* and valves, it acts equally on both, so as to raise the weight to one side of the wheel; and by the re-action on the valves successively, to give a circular motion to the wheel, the valves opening in the direction in which the weights are pressed. As the steam vessel moves round, it is supplied with steam from the boiler, and that which has performed its office may either be discharged, by means of condensers, or into the open air."

Now that we have made the language a little clearer, we shall proceed to describe such a machine as we imagine the inventor had in his mind; informing our readers that the hollow arms, form of the valves, manner of admitting the steam and allowing it to escape, are added as the best means we can devise to answer the proposed end; but we are not aware how they were really formed, whether at the time the specification was drawn up, the inventor had any decisive plans in view; or, that he (like too many patentees) trusted to the resources of his own mind to supply them when he proceeded on the experiment.

*d d d* is the circular channel, bolted together in segments, in which the weight, made of cast-iron or lead, *f*, can move freely. The weight is packed with hemp at *g*, so as at that part to fit so tight in the channel, as to prevent the steam from escaping past it. . *iiii* are four hollow arms, communicating with the hollow ring, and with a cylinder or bush *j j*, into which is fitted a circular plate of metal *k*, having two cavities *a b*, in the situation shown in the drawing. *k* is covered with another plate to which it is accurately fitted, to this outer plate is attached the eduction pipe which communicates with *a*, and the induction pipe, which communicates with *b*; the plate *k*, and its covering, remain stationary, whilst the wheel revolves, and the open end of the arms *iiii*, successively pass over the open spaces *a b*, and admit the steam or suffer it to escape, as we shall now explain.

The steam being admitted from the boiler rushes through the arm *i 3*, into the channel, and, shutting the valve *e 1*, or finding it already shut, forces up the weight *f f f* into one side of the wheel, (as shown in the drawing); this causes that side to preponderate, and in endeavouring to regain its former position makes the wheel to revolve. But, in the mean time, a supply of steam is kept up from the boiler, which preserves the weight in its present position, driving the wheel round in the opposite direction, whilst the valve *e 2*, having passed the situation it is now in, is shut by the lever *l*, striking the tappet *m*, and receives the force of the steam, previously upon *e i*. When the wheel has revolved a little further, the arm *i 3* communicates with the eduction passage, and allows the steam to escape which was between the valves *e 1* and *e 2*. Immediately after, the valve *e 1* strikes against the friction roller *h*, and is by it forced into the recess, assuming the position of *e 4*. At the same time the valve *e 3* has got clear from the weight, and falls by its own gravity into the position

of *e* 2, after which it is shut by the tappet *m*, in the way already explained. Thus the valves successively receive the action of the steam, and the weight being preserved in its elevated position the wheel continues to revolve.

Such was the plan designed as the first rotatory engine. It is because it *was* the first, and because it was the invention of Watt that we place it here. In itself it possesses few claims to our attention. If such a machine could ever be made, (which is doubtful) the excessive friction of the weight moving in the channel would exceed that of the common engine tenfold. But the worst fault would be, that the packing could not be preserved steam tight for any length of time: for hempen packing it is well known cannot pass over in its course any cavity, or irregularity of surface, without being soon torn out, and rendered incapable of performing its office. It would also be required that the interior of the channel should be accurately turned, which might be effected in small engines by turning a section of the wheel at once, (such as our drawing represents) and afterwards bolting two of such sections together; but in large diameters, such as would be absolutely necessary for large powers, the vibration would render their being turned an absolute impossibility.

We cannot learn whether Watt ever proceeded on the experiment. He himself states that—"a steam wheel, moved by force of steam acting in a circular channel, against a valve on one side, and against a column of mercury, or other fluid metal, on the other side, was executed at Soho, upon a scale of six feet, and tried repeatedly, but was given up as several objections were found against it." From this we may conclude that the patented machine had probably been tried and abandoned, on the ground of excessive friction.

[To be continued.]

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## London Mechanics' Institution,

FRIDAY, 19th of MAY, 1826.

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### MR. TOPLIS'S FIRST LECTURE ON MECHANICS.

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On Friday, the 19th instant, Mr. Toplis delivered his introductory Lecture of a Course on Mechanics. He commenced by observing, many members of the Institution might have had cause to regret that so long a time had been allowed to elapse since the delivery of a course of lectures on Mechanics, a science claiming, above all others, their attention, mixed up as it was with their peculiar interests. He could answer for it, from having been one of their committee of management, that the importance of this science had not been undervalued; all with whom he had been in connection had been most anxious to procure a renewal of this subject, which they were in hopes would have been resumed by that highly gifted individual who was their first instructor. This wish had been, by peculiar circumstances, frustrated for the present. He (Mr. Toplis) became impressed with the impolicy and injustice of procrastinating a renewal of the subject to an indefinite period, and therefore offered himself to fill up the vacuum, not from any consciousness that he could supply the place of the eminent gentleman before referred to, but from

a desire that they should not retrograde, before that individual could have the power and satisfaction of resuming his valuable instruction. As it was two years since a course on Mechanics had been delivered, many new members must have joined them, and with the hope, probably, of hearing such a course. In common equity to them, then, and to place them on an equality with those who had already received instruction on this subject, that they might all start from the goal together, when a more qualified teacher should appear, he had offered himself on the present occasion. To many of them his commencement might seem too elementary, but he begged them to consider that the assembly might comprise many who had to receive the first and simplest rules of the science, which they must be made acquainted with before they could understand its more remote inductions.

The science of Mechanics consisted of that system, derived from an investigation of the laws of motion.

There could be no doubt but that many men have become great practical mechanics without having any knowledge of the abstract principles, or of the theory; and it might be inferred, therefore, that this was of little consequence. But admitting, that without such advantage great eminence had been attained, it had in all instances been dearly earned; the misdirection of ingenuity and talent, and the waste of time and labour, must have been material. Man was estimable in society in proportion as his labours and occupations contributed to the happiness of those of whom he formed a part; and as no man could advance himself without leading others along with him, the more we attended to our own improvement, the more must we add to the dignity of the whole human race. They were told, however, that to teach the abstract principles of sciences was to subvert the order of society. How, he was at a loss to conceive; and he was equally at a loss to imagine how the advancement of the theory of the sciences could be useful but in proportion as they bore practically on the advancement of the operative. He who confined himself to the theory of science, the inoperative recluse, might remain ignorant of the commonest facts, while the practical mechanic looked into the stores of science for new principles, and new application of principles. What claim would the principles of Newton possess if they had been known only in the retreat of the closet. The expansive force of steam was a power of the first energy; but what would it have signified to have known this, without its application? As it was, it had contributed to our prosperity; it threatened to make want and penury a "record of the past." Our advancement in mechanics had rendered our country the "envy and admiration of the world;" it had raised her to her present height, and would maintain her at it; could there be those, then, who would withhold that improvement from the minds of our mechanics which would open the way to our external as well as internal strength. If they referred to cotton alone, and counted the number of hands its manufacture called into activity; if they then considered that it was scarcely half a century ago since this secret was divulged; if they referred to the name of Arkwright only, they would be furnished with a host of argument in support of this proposition.

All motion involved the transit of matter through space. There was a chemical motion under the head of chemical affinity, which it would not be their province to enter into at present. The motion of a body through space was not governed by casual vague, but inflexible laws. The ascertaining of this was a proud triumph of experimental philosophy. It was the first sure footing science had gained, and we were indebted for it to Newton.

Nothing was more easy to conceive than a state of repose: yet in nature no matter was really so circumstanced; for suns and their systems were in ceaseless and rapid revolution, and every portion of the globe was, therefore, constantly shifting its station. They might conceive, however, a body to be at rest, though they knew it could not be in such a state. When they spoke of a body at rest, they implied that it was in relative quiescence, which meant that a body preserved its position in relation to other bodies. Though bodies might be carried along with respect to the universe, they might remain fixed with respect to each other. Bodies were maintained in a state of quiescence by a power actually ascribed to the bodies themselves. We knew

if we raised a stone from the ground, it required an effort of power to lift it equal to the stone's weight; and if we let it go from our hand it would fall to the earth.

If ordinary individuals were asked why the stone fell, their reply would be, because it had weight, which was evident by its removal requiring an exercise of power; and this solution carried with it conviction to the superficial observer. The mind of Newton, however, was not to be so satisfied: he had enquired why an apple fell; and he discovered the law of gravity which rules the universe; he found that all matter has a tendency to approach when moving in a free space. Thus when an apple, stone, or other body fell to the ground, the power necessary to raise it was a measure of the power of attraction to be overcome.

It was said a body at rest would for ever remain, so if not influenced by external causes; and if put in motion and left equally free, it would for ever continue moving, and in a right line. It was not difficult to conceive, that dead matter, if at rest, would continue so; that it did not possess a self-generative power of motion: but it might not appear quite so practical, that a body once put in motion, must for ever keep up that motion, if not operated upon by extrinsic forces. This was so opposed to our ordinary notion, that the enunciation of it was calculated to startle the mind. That motion, which resulted from a stone being thrown, or from the operation of any other power, might be explained: but how could they assign to any body the power of never-ceasing motion. This was the reasoning of novices: but the fact was drawn from data, drawn from experiment: it was one of those things, of which induction from experiment got not the truth. He would have them, however, contemplate the innumerable orbs, and ask, when they saw the beautifully assembled systems, whether the boldest intruder into nature's arcana could say that this motion would ever cease? If we had the power of projecting a body beyond our resisting atmosphere, it would continue to move in free space with the velocity once imparted, for there would be then nothing to abstract from the power given, nothing to impede perpetual motion. These relations of matter to motion, were embraced in the term *inertia*, which meant the disposition of a body when undisturbed to retain its position, and when moved to continue its motion. He had endeavoured to make this fully understood, aware that the great fault of teachers was, they too frequently forgot they themselves were once learners.

Motion, distance, and time involved change of place. The passage of a body gave us distance; and distance and time made up our compound velocity, which was the space determined in a certain period. Velocity always considered how far a body travelled in a given number of seconds or minutes. *Equable* or *unequable* velocity meant the different degrees of that velocity. There were *equable*, and *unequable* *crescent*, and *decreascent* velocities. The lecturer here presented two pendent balls, and observed, that when one body was allowed to fall against another, they must measure the distance described on the board by the latter, and the time, and multiply them together, which would give the velocity.

A body in motion possessed a certain degree of power. All agree that this existed, for few would like to oppose themselves to a small ball of lead projected from a pistol. This power was in proportion to the force of the projection, not to the bulk of the body. It was here shown by the board and two balls, that the increase of the projectile force augmented the range of movement; and hence it was inferred, that velocity became a measure of force. Gravitation exercised itself in proportion to the quantity of matter. Inertia, then, was the common property of all matter; and hence there were two elements to take into calculation—inertia and velocity, which would give the whole compound force possessed by any moving matter.

To shew the momentives of a moving body, Mr. Toplis exhibited two weights equally balanced. He then placed an additional weight to one of the bodies, which elevated the other. At a certain point this additional weight was received by a ring, and the two bodies were thus restored to an equality, but the motion once acquired was observed to continue; the body which had acquired momentum afterwards describing a considerable distance.

The force of gravity had been here destroyed by the equipoise, and the power which carried the body on must therefore have been acquired.

Every body comprised a point, considered as concentrating the whole of the common mass, as affected by the action of external forces. On a globe of uniform density this point was the centre, or that point equally distant from every part of the surface. In a flat body it was an imaginary line which one part of the body in revolution would describe by moving parallel, while every other part would be describing a curve. The path of a body then was shown by the centre and no other part. This point was termed the centre of gravity, or would be more properly perhaps called the centre of inertia. When a stick was thrown it did not proceed longitudinally, it acquired a rotatory motion, and its centre of inertia was that point which described a parallel line.

An arrow, a javelin, or a rocket, proceeded longitudinally, because of the great weight at one end, and the resistance of the atmosphere acting on a long lever, which overcame the tendency to revolution; but these bodies, in space, would acquire curvilinear motion. The rectilinear motion of the arrow was preserved by the feathers, which increased at one end the resistance of the atmosphere.

When two or more bodies were connected, like chain-shot for instance, they found one common centre of inertia, round which they revolved.

Mr. Toplis concluded his excellent lecture with pointing out what would be the centre of inertia of several irregular forms.

Dr. Gilchrist announced, that the committee had made arrangements for the formation of a class, to meet weekly, for the purposes of mutual instruction. Those members were requested to attend on Tuesday, at 8 o'clock, who were desirous of forming such a class. The worthy gentleman also gave notice, that unless all books were returned by the 31st instant, a fine of 2s. 6d. would be levied, agreeably to the regulations of their circulating library.

On Wednesday last Mr. Hogg was prevented delivering his first lecture on Geology, by indisposition. There were, however, some valuable observations made by Dr. Birkbeck, which we purpose reporting next week.

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## NEW MODE OF REFINING SUGAR.

In the process of refining the syrup from which lump sugar is crystallised, it was commonly cleared by means of the blood of animals, or other albuminous matter; and this part of the process has always been considered objectionable in the preparation of an article of food; at the same time that it is neither so economical, nor so certain as could be wished. Under these circumstances many attempts have been made to render the use of such articles in the clarifying process unnecessary. The new method adopted by Mr. Charles Frenne, and recently patented by him, consists in the employment of pearl or pot-ashes, and a light-coloured species of fuller's earth.

To clear 2000lbs. of raw or Muscovado sugar, 85 gallons of water are put into the pan, to which, 15lbs. of American pot-ash is added, which is put into the empty pan while it is hot from the operation of refining the preceding panful. When the ashes are thoroughly dissolved in the water, the 2000lbs. of sugar are added, the whole well stirred, and then allowed to rest for about three hours. From 20 to 30lbs. of the fuller's earth is then smoothly mixed up with water to the consistence of cream, and then added to the sugar in the pan, when the whole is well stirred up together. Thus prepared the fire

may be lighted, and 70 gallons of water added to the previous mixture to reduce the consistence sufficiently for the scum to be thrown up and separated.

The settling cistern, into which the clear liquor is run, has three stop-cocks inserted at different heights, and runs upon an axis near the middle of its length, and may be elevated or depressed at one end by the turning of a fine threaded screw, by which the clear liquor may be drawn off much closer to the sediment, than when in a fixed cistern. *News of Literature, &c.*

### ROBERTS'S PATENT MODE OF PRESERVING POTATOES AND OTHER VEGETABLES.

THE patentee of this *singular discovery* is Mr. Alexander Roberts, of Monford Place, Kennington Green. He states in his specification, that he has for several years directed his attention to the preservation of potatoes and other vegetables, so that they might be kept in the warmest climates for a considerable time; and that he has found the most effectual method to consist in destroying the germinating parts. His directions are simply as follows: "Take potatoes that are thoroughly ripe, and before they have grown in the spring, cut out with a knife or other instrument, or otherwise destroy the germs or eyes. The more they are kept from the air, the finer they will be. Carrots, turnips, and other vegetables, in like manner may be preserved by destroying the growing or germinating parts."

### Discoveries & Processes in the Useful Arts.

**IMPROVED PAPER FOR DRAUGHTSMEN.**—An improved method of preparing paper for drawing upon has been recently noticed in several of the periodicals. It is directed that gum tragacanth be reduced to a powder, and dissolved in cold water; taking care to work it well with a spatula to free it from lumps, and render the mucilage of an uniform consistence, which should be such that it may be easily brushed smoothly over the paper; which may then be carefully dried before a gentle fire. Paper or linen thus prepared will take either oil or water colours, but rejects ink. When water colours are employed, it is recommended to mix them with a solution of the gum tragacanth. If any part of the drawing requires retouching or alteration, such part may be washed away with a sponge or pencil containing a little of the mucilage, and be then repainted.

**EFFECT OF FOILS ON THE TEMPERATURE OF THE HAND, BY COMPRESSION.**—Mr. Murray has observed, that if a person grasps together in the hand a few foils of copper or silver leaf, a peculiar glow of heat is felt, which raises the mercury in a thermometer held in the hand several degrees. The sudden compression of the air between the folds of the leaves is most likely the cause of the phenomenon. *News of Literature, &c.*

**CORK-CUTTING MACHINE.**—A machine of great simplicity in its construction, is employed in France, for the cutting of bottle corks by which, it is said, the attendance of a child only is sufficient to produce 500 corks per hour. The sheets of cork are cut into strips by a distinct machine, and made round by a second process.

**FIRE AND WATER-PROOF CEMENT.**—Pour a pint of vinegar into a pint of milk; when the latter has fully coagulated clear it of the lumps, and let it settle; then add the whites of eight eggs to it, and mix the whole well together; afterwards some powdered quick lime, which may be sifted through a fine sieve into the liquid, stirring it up from time to time until the whole has become a thick paste. By this process a fire and water-proof cement may be prepared, capable of permanently uniting marble, porcelaine, earthenware, &c.—*French Paper.*

**AGRICULTURE.**—This art, as it has been usually termed, there is reason to hope, from the zeal and intelligence of our Gallic neighbours, will, ere long, rank among the sciences, where it ought, indeed, to hold the highest place. Numerous farms have been taken in various parts of France, solely for conducting agricultural experiments on a suitable scale.

### SOUTHWARK MECHANICS' INSTITUTION.

A NUMEROUS meeting of mechanics and others took place at the Three Tuns' Tavern, High Street, Borough, on Monday evening last, at which it was resolved to establish a Mechanics' Institution in the Borough of Southwark, to be entitled as above. Mr. Alderman Wood, who was present, was unanimously elected president. The worthy Alderman directed his name to be put down for 10/. A letter was read from Mr. Brougham, apologizing for his absence on account of indisposition, approving of the undertaking, and enclosing a subscription of 5/. A letter was likewise read from Sir Robert Wilson, also approving of the formation of the Institution, but recommending the members of it to carry their object into execution by their own exertions alone, without the aid of patronage. Amongst the resolutions adopted by the meeting, was one excluding all political or religious subjects from their lectures.

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CORRESPONDENTS will be replied to in our next.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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**EVE'S PATENTED IMPROVEMENTS IN STEAM  
ENGINES.**

*(Continued from our last number, page 32.)*

In continuing this subject, we shall again avail ourselves of the clear descriptions given in the specification. With respect to the illustrative diagrams, it is proper to notice, that we have in a slight degree altered the order of them, by placing figure 25 in the preceding page ; this we have done to shew in the frontispiece to our present number, the nature and the application of the whole of the improvements of the ingenious patentee, at one view. Thus, the steam generating apparatus in fig. 15, is shewn at fig. 25 enclosed in the brickwork ; the latter figure exhibiting also, the revolving cocks ; the new safety apparatus ; the arrangement of a high and low pressure rotatory engine ; so as to be worked by the same steam, &c. These several contrivances being described in detail in the following pages, and by the annexed diagrams, with occasional reference to those preceding, we now proceed to them ; first as respects :

**THE TUBULAR CIRCULATORY STEAM GENERATOR.**

Figures 15, 16, 17, 19, exhibit various views of my said second particular, and which I call my circulatory tubular steam

generator, as also of my said third particular, being an arrangement of two revolving cocks, to supply the waste of water, in lieu of the forcing pump, *fig. 15* is a side view, *fig. 17* a front view, *fig. 19* a back view of the said generator. The same letters of reference apply to all the figures, *a* is the lower conduit pipe, *B* the steam receiver, *c c* are two pipes, in which the water descends from the steam receiver, to the lower or conduit pipe, *d* is the dome connected with the steam receiver, from which dome the steam enters into the steam-pipe *F*, and into pipe *E*, which latter leads to the safety apparatus. *g g g* are ten pipes, which communicate with the lower conduit pipe, and the upper pipe or steam receiver. *Fig. 16* represents one of these ten sections in front, and the manner in which they are formed, and bent, and connected with the two horizontal pipes, which latter are shewn in section in this figure. *h* and *i* are two valves, the former kept open by its own weight, and the latter floating. With these two valves every section of pipes is provided at its two orifices, where they communicate with the lower conduit and steam receiving pipe; *p p* is the grate and fire place, over the middle of which the smaller combination of pipes are placed. *o o* is the ashpit, *q* is an end, which screws into the lower conduit pipe, by means of which the same may be cleaned out, when necessary. The number of sections, number of pipes composing each section, and the manner in which the pipes are bent, are arbitrary. The generator or boiler is filled with water through the orifice *o* in *fig. 15*. The heat of the furnace will cause the water to circulate constantly through the tubes, thereby preventing the steam from driving the water out of them, and by which means they are in a great degree prevented from burning out, or oxidating. My tubes in the sections are  $\frac{1}{2}$  to  $\frac{1}{4}$  inch thick, and 1 and 2 inches diameter; they may be of copper, iron, or any other metal, which is sufficiently strong, to bear the pressure. This pressure will be comparatively small on account of the small size of the pipes, although steam of the highest pressure be used. My horizontal pipes are  $1\frac{1}{4}$  inch thick and  $9\frac{1}{2}$  inch diameter, the vertical pipes  $\frac{1}{2}$  inch thick, and  $4\frac{1}{2}$  inches diameter.

The valves *h* and *i* attached to the orifices of each of the section pipes, where they enter into the horizontal tubes, are placed there in case of a rupture in one of the sections to which they belong, in which case the unbalanced pressure of steam would force the water so rapidly into the particular section that was ruptured, as to cause the valves to close, thereby preventing any waste of steam, and detaching the ruptured section from the rest of the generator; whereby the engine need not be stopped, but would only lose so much of its power, as the proportion of one section to the remaining sound ones would be. The two large vertical as well as the two large horizontal tubes are imbedded in brick work, and the sections only are exposed to the heat of the fire, therefore no steam will be formed or generated in the former, while the action of the fire will cause the steam and water to ascend rapidly through the small pipes into the steam

receiver, while the water in the steam receiver, being heavier than the water combined with steam in the smaller pipes, will descend through the vertical tubes into the lower conduit tube, thereby causing a continual circulation through all the tubes, great and small; the steam will of course accumulate at the top, and through the dome find its way to the steam pipe and safety apparatus. In case the circulation should be too rapid, and to prevent the possibility of the water being forced into the steam pipe before it descends again through the vertical pipes, I have placed a piece of sheet iron, perforated with small holes similar to a strainer, in the middle of the steam receiver all across from end to end. I have given to the small pipes in the sections the peculiar serpentine form in order to enable the steam to rise to the top more rapidly than the water.

My generators or boilers are supplied with water by means of one or two revolving cocks, to serve in lieu of the forcing pump, as shewn in *fig. 19*, where two cocks are represented, and which number I prefer. *n* is a vessel filled with water of any convenient shape, one side of which vessel is near the furnace, so as to keep the water warm; this vessel is connected with the generator through a tube entering at *O*, which is shewn in section in the drawing; this tube has two revolving cocks *K* and *L* with a chamber between them. The cocks are made to revolve equally by cogwheels gearing into each other, so if cock *K* is open towards the water reservoir, cock *L* will be closed towards the tube leading to the generator.

The chamber between the cocks will therefore be filled with water through cock *k*, by that time cock *k* closes, and *L* opens towards the generator; the water in the chamber will then descend through *o* into the generator by its own gravity, and its place be occupied in the chamber by steam from the generator; cock *K* opens again towards the chamber, and *l* is closed towards the generator. The steam in the chamber will be condensed by the water now entering, or escape into the water reservoir *n*, this revolution goes on continually. If water be presented by cock *L* to the generator, and the said generator should be sufficiently full, the water being up to the dotted lines, in such a case the water will not be received, but remains in the chamber until part or the whole is wanted, the cocks constantly revolving. By this arrangement the water can be kept constantly at the desired height.

*Remarks by the Patentee on the foregoing.*—"It is presumed, that, from a steam generator so small as the above described, containing so little water and steam, with the provision made in its construction, against danger, even were a rupture to take place, no accident could possibly happen to persons near the engine.

It is obvious that the quantity of fuel consumed will bear a proportion to the size of the boiler or generator, and that comparatively very little can be consumed in so small a furnace as my generator would require.

The revolving cocks completely supply the place of the forcing pump, without its disadvantages; there is next to no loss of power, which in the other is often very great; there is no necessity of

watching it, as it will furnish the generator with the exact quantity of water required, without attendance, which is not the case with the forcing pump."



Figures 20, 21, 22, 23, elucidate my IMPROVEMENTS IN THE SAFETY APPARATUS as applicable to my tubular circulatory steam generator, or to any other boiler, where high or low pressure steam is generated. *Fig. 20* shews a longitudinal section of the compound tube, *a* is the piston rod screwed into the piston *b*, which piston fits into the cylindrical tube *E*, screwed or otherwise fixed at its base into the pipe that connects it with the steam receiver or boiler.

*O* is a hole perforated through *b* to allow the steam to ascend into the hollow space *n* above the piston, so that the pressure is equal on both sides with the exception of the piston rod, the diameter of which alone is unbalanced. The piece *k k* screwed into the upper part of tube *E* prevents the steam from ascending higher, another piece *g g* having a hollow space on the top is screwed into *k*. Both these pieces have a hole bored in their centre lengthways of a diameter equal to the piston rod *a*, and to allow it to work up and down. The hollow space in the middle of the two pieces *g* and *k* is filled with packing, so as to prevent any escape of steam lengthways the piston rod.

The hollow space *p* at top is filled with oil, *k k* is a basin with water up to the dotted line to keep the upper part cool; the weights, with which the safety apparatus are intended to be loaded, are placed on the collar *m*.

The hollow tube E has longitudinal openings, as will be perceived by *fig. 23*, which presents an outside front view of the apparatus; and through these openings the steam escapes, whenever the piston *b* rises. These holes may be of an indefinite length and breadth. A jacket *f* represented by *fig. 21* which fits over the tube E, and has likewise the same number of longitudinal holes cut through it, slides over the said tube, and by adjusting this jacket, the channel for the escape of steam can be made narrower, according as it may be desirable to have the piston raised more or less. The hollow vessel L, or a vessel of any other form, slides, or is otherwise fixed over the lower part of the apparatus, so as to intercept the steam from incommoding the upper part of it, when the rod is loaded.

The pipe *g* leads from this hollow vessel L to the steam condenser, or serves for the escape of steam; *fig. 22* presents an outside view of the piston, *a* is the rod already described, *e e* are packing rings, two on the upper side, and two on the lower side, these rings press against the tube E, in order to keep it steam tight, so that no steam can escape through the longitudinal openings; *d d* are two pieces of metal screwed on at the top and base of the piston, to confine the packing rings.

*Fig. 25* exhibits an elevation of my said compound steam engine, with the aforesaid arrangement of cogwheels constituting my said 5th particular.

A is the furnace containing the steam generator or boiler; B is the dome on the top of the steam receiver with the steam pipe *c*, and safety apparatus M; D is a cock upon pipe *c*, through which steam is admitted to the high pressure engine E, after having acted upon it, the said steam passes into the low pressure engine F; constructed on my principle on a larger scale, so as to allow the steam to expand, and then act upon it as low pressure. E and F have pinion wheels of an equal pitch gearing into a spur wheel G, these wheels determine the power given to each engine, by regulating their motion with reference to the power required from each. The steam finds its escape at Z into the condenser H.—The condensed steam or water runs through pipe I by its own gravity, towards the two revolving cocks *k*, whence it is conveyed back to the feeding pipe in the steam generator. V is an engine constructed upon the plan elucidated by *fig. 5* and *6* on sheet first, having two induction and two eduction pipes, which engine serves as a pump in this particular situation. Pipe *w* sucks the water from the well or river, and carries it into the refrigerator; *x* receives the water in the refrigerator and carries it downwards. P is the bellows fanning the fire, by means of a band round the axle Q connected with the pulley T, or by any other contrivance. O is the valve and lever of the bellows connected by rod N with the safety apparatus; T and U are pulleys connected by a band, to give rotary motion to pump V, but any other contrivance may be used: L is a cock, which is only opened before the engine is set to work, in order that the air may be driven out of the pipes and condenser by the steam, the cock may then be shut and the engine set to work.

T is a pipe leading from the safety apparatus to the condenser, therefore if an engine be so contrived, and the boiler be once filled with water, the same water will answer for working the engine, as long as all the pipes through which the steam and water circulate are tight, or at any rate the loss of water will be very inconsiderable.

Now whereas, I claim as my invention, first, the general arrangement of the rotary engine hereinbefore described, and in particular that conical shaped part, which I have called a conical runner: 2dly. the particular construction of generators hereinbefore described: 3dly. the revolving cocks hereinbefore described, but only as applied to the purpose of supplying water to the generator, instead of the ordinary forcing pump: 4thly. in the new safety apparatus hereinbefore particularly described: and 5thly. in the particular arrangement of a compound engine, and the cog wheels regulating the high and low pressure, as hereinbefore described. And whereas these last mentioned five parts of my invention, so claimed as aforesaid, are the five particulars alluded to in the former part of this specification:

*Further observations by the patentee.*—The difficulty of availing ourselves of the advantage of using steam twice, that is, first as high pressure, and then in a condensing engine, to any extent, is sufficiently apparent from the following considerations: It appears, from Mr. Wolfe's experiments, that steam heated to balance 6lbs. to the inch, will expand into six times the volume under atmospheric pressure, at 20lbs. to 20 times, at 40 to 40 times, and so on.

Working with comparatively so low a pressure as 40lbs. to the inch, it would be found extremely inconvenient to use two engines whose capacities were as one to forty, and, if not impossible, would appear ridiculous, if steam of 200lbs. elasticity (which is quite common in the United States) be used, as the second engine would have to be 200 times the capacity of the first, which in this extreme case would at least have a disproportionate appearance. All reciprocating engines, or those having reciprocating parts, will have to contend with this inconvenience, or rather can only avail themselves of a partial advantage from using high and low steam, as they have to work stroke for stroke. With my rotary steam engine the full benefit of this principle may be appropriated, as the engine that acts by high pressure may be smaller in the first instance, and then the engine for low pressure may be made to revolve as much faster than the first, as to allow of the full expansion of the steam before it is acted on, for the velocity may be carried to any extent required without inconvenience.

It is presumed that it will not be too much to say, from what has been known to be done by using steam twice, on Mr. Wolfe's principle, even with the reciprocating engines, that a saving of half the fuel may be achieved, when applied to my rotary engine, which is so much better adapted to give it full effect; nor ought it to be considered extravagant to anticipate that a moiety of the balance will ultimately be saved, by some of the new modes of generating steam, which the ingenuity of so many competitors has elicited, among whom I have ventured to enter the lists with the one submitted in the annexed diagrams.

If the seal of experience should testify to the truth of these anticipations, steam navigation over the great deep, and the general adoption of locomotive carriages, may not be considered, as at present, the dreams of a visionary.

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### HILL'S AND HADDOCK'S PATENT

FOR AN IMPROVED METHOD OF MANUFACTURING SULPHURIC ACID.

INSTEAD of employing pure sulphur for the preparation of sulphuric acid, the patentees propose to use metallic sulphurets, or such other substances in which sulphur may be contained in a state of chemical union; and to convert the residuums of such sulphurets, after combustion, into articles of valuable consideration in commerce. The following process is that adopted by the patentees.

The sulphurets are ignited in a distinct vessel or series of vessels, from those in which the condensation is effected; these vessels may be made of metal, earth, or any substance capable of withstanding the required heat to complete the combustion, and also the action of the sulphuric acid or other gas that results; they are placed over a furnace, in which the fire may act uniformly with a proper intensity; the vessels are charged with the sulphurets by means of one or more apertures, which are left open for the supply of atmospheric air, as a medium for the conveyance of oxygen to assist the combustion; and likewise as a means of assisting in the subsequent condensation of the vapour, in a series of separate vessels into which it enters by tubes or channels of communication; the apertures being only closed when a re-action takes place, to prevent the escape of the gas. During the operation, steam, in conjunction with atmospheric air, is occasionally conveyed into the condensing vessels, by which (the patentees state) the gas is more rapidly and perfectly condensed into sulphuric acid than by any other method hitherto practised.

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PATENT GRANTED TO JAMES HANMER BAKER, ESQ. OF ST. MARTIN'S LANE,

### FOR IMPROVEMENTS IN THE ART OF DYEING AND CALICO PRINTING.

THE improvements of the patentee consists in the application of the husk and shell of the cocoa nut, in the preparation of a dyeing material for silk, cotton, wool, flax, &c.

The leaves and branches, the trunks and roots, and indeed every part of the cocoa-nut tree, yields the tinging matter, but the husks of the nuts, and footstalks of the leaves, are preferred, as the most convenient and cheapest to be operated upon: these are to be split into small pieces, and thoroughly dried; and they may afterwards be ground in a mill, when the colouring matter will be readily extracted by infusion in hot or cold water, which will be facilitated by the addition of any of the alkalies to the liquid.

As tannin and the gallic acid are amongst the matters in solution, it is essential that no vessels or utensils of iron should be used, which would turn the liquid black; it is, therefore, recommended to employ a wooden vat which may be nearly filled with the ligneous matter above mentioned, and afterwards quite filled up with cold water, a frame being so fixed in the upper part of the vessel as to prevent the materials from rising above its surface. In this state it may lie until the liquid has acquired a yellowish brown tint, which, with cold water, will take two or more days according to the temperature of the weather. This first infusion may then be drawn off by a cock at the bottom of the vat, and a second or third charge of water added to extract the remaining portions of colouring matter.

To dye cotton, linen, woollen, or silken stuffs, they are to be cleansed, saturated with the usual mordants, and afterwards dipped in the above extract or infusion, when they will take a fine nankeen colour of great durability. The mordant preferred for cotton goods is a solution of alum, the acid in which is to be neutralized by chalk. When the infusion is applied to goods, to print off a design or pattern, it is directed that those parts of the pattern intended to be white are to be covered with any of the mixtures commonly used as a guard, previous to their being dipped in the infusion.

A more expeditious mode of extracting the colouring matter from the material, is to employ hot water, when an hour and a half's boiling will suffice to obtain a strong tint, that will dye goods by merely dipping them and drying them immediately, but it is preferable to pass the goods first through an alum mordant. Another mode employed is to dip the goods in two or three times, drying them between, and then heightening the colour by the nitromuriate of tin, the nitrate of lead, or the oxymuriate of lime; after which they should be immediately well rinsed in cold water, to prevent further action on the colour.

As mentioned before, the infusion contains besides the colouring matter a considerable proportion of tannin and gallic acid; therefore it will give with any of the salts of iron a blue-black colour, which may be modified in various ways by a mordant.

From the quantity of astringent matter in the husks and footstalks of the cocoa-nut tree, they may be advantageously employed by the dyer instead of the more expensive nut galls, in dyeing Turkey red and other colours. By mixing, in the manner of dyers, the cocoa-nut infusion with red dyes, a great variety of olives, drabs, browns, greys, and other tints, may be obtained of great beauty and durability.

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## PARKER AND HAMILTON'S PATENT "MOSAIC GOLD."

### ITS COMPOSITION AND PREPARATION.

SOME five or six months ago, when the Patentees put forth their circular or prospectus respecting this wonderful discovery, in which the properties of the composition were made out to be of greater importance than those of real gold itself, it was inserted, verbatim,

in all the periodicals, with the exception of our own; and we must confess, that we were so far dazzled by its brilliant qualities, as to send it to our printers for insertion. A little reflection, however, caused us to add a few remarks, expressing an opinion that this great discovery of the "Mosaic Gold," would turn out to be some fine coloured alloy of copper, well known at Birmingham, and to the workers generally in fine yellow metal, or "or-molu;" and that its property of not oxidating by exposure to the air (as far as that was the fact), was derived, like many of the alloys of copper, from its containing a large proportion of zinc, the operation of which as a preservative to ships' copper, by electro-chemical means, has been the subject of so many able papers by Sir Humphry Davy. A little more reflection still, caused us to think, that the insertion of the article in question had better be omitted entirely, especially as our contemporaries had given the subject so much publicity; and that it would be advisable to wait the enrolment of the patent, when we should be enabled to give the real facts.

This document, which is now open to the perusal of the public, directs, that equal quantities of copper and zinc are to be melted at the lowest temperature at which the former will fuse, when they are to be well stirred and mixed together; small quantities of zinc are then added by degrees, until the alloy assumes the desired colour. It is essential that the heat should be as low as possible, to prevent the rapid evaporation of the zinc. The alloy first assumes a yellow colour; the addition of more zinc, turns it first to a purplish tint, which ultimately becomes perfectly white, which is the colour it should have when in a state of fusion. It may then be cast into ingots for use; but it is better to cast the alloy in the first instance into the forms required, as a portion of the zinc flies off on remelting. So much for the specification of this discovery; of which, were we not mere theorists in the matter, we should say was at least a very injudicious process for making fine yellow, or or-molu brass, and were it not for the Patentee's statement, that the composition and process are the result of years of experiment and investigation.

~~REGISTERED~~

### HIRST AND WOOD'S PATENT,

FOR CLEANING, MILLING, OR FULLING CLOTH.

THIS patented improvement simply consists in the employment of steam in the operation of cleaning and fulling cloth, instead of soap and water; which effects a saving of expense, as well of time in conducting the process. The stock wherein the cloth is put and beaten, and the other parts of the apparatus is the same as used in ordinary. A steam pipe is merely introduced into one side of the stock and made to blow through a number of small holes so as to insinuate itself among the folds and through the interstices of the cloth, by which the oily matter is extracted and carried off by the condensed steam.

**London Mechanics' Institution,***FRIDAY, 19th of MAY, 1826.*

We stated in our last number, that Mr. Ogg was prevented delivering his Lecture on the previous Wednesday, by indisposition. Dr. Birkbeck presented himself with Mr. Ogg, and was loudly cheered. After Mr. Ogg had made an apology for not being able to proceed,

Dr. BIRKBECK thanked them for their attention now that he was able to meet them. He had been confined by a long and severe indisposition; and if there was one thing more than another which he had to regret as consequent on that indisposition, it was his being compelled to absent himself from his duty to this Institution. He had derived great satisfaction from observing that every thing proceeded in the most advantageous and most harmonious manner. This opportunity of watching their progress, was afforded him by that admirable periodical, the Mechanics' Register, in which their proceedings were reported with an ability, with a fidelity and spirit, such as he met with in no other work, either now or ever before published. He saw that they had been admirably supplied, and by the exertions of their valuable committee, this supply was likely to be continued; a course on Mechanics was being delivered, and the individual before them was about to commence a course on a subject of the deepest and most curious interest. He regretted to say, he had been repeatedly asked by anonymous letters, when he meant to deliver a course of Lectures which he long since promised. He regretted this, because the letters were anonymous; he considered their correspondence an honour; and he saw no reason why the writers should not have given their names. The Lectures to which he alluded were on the structure and functions of the human body; and he hoped in the course of the Summer to commence, if not complete them. In the mean time he proposed going on with those practical Lectures of which he had already delivered two. When the two courses should be completed, he proposed to introduce an account of various mechanical contrivances. These he should be able to illustrate partly by means of diagrams, with which he had been furnished by the Editor of the Register of Arts and Sciences, partly by models which had been sent to him from different parts of the country, and partly by machinery, which he could command and present to them in the actual working form. He was particularly anxious to call their attention to one of these machines, because it formed just now an object of peculiar interest. It related to the art of weaving by a rotatory machine, or the power loom, as it is called. This machine was brought from France, and was the invention of an ingenious Frenchman; and he proposed making them acquainted with its operations by the assistance of the machine itself, with which, that they might be enabled fully to comprehend its construction, he had been supplied with all its appendages by the ingenious proprietor and inventor. He considered this subject important not merely politically; it involved an inquiry as to how far this species of machinery was calculated to extend the comforts, and contribute to the benefit of the manufacturers. The power-loom had already experienced the fate of a great many kinds of machinery on their first being introduced; but it was a curious question to what extent, or what possible, or imaginary evil such machinery might be able to inflict. He should refer to another species of loom, for he wished to exhaust the subject of weaving, which, when introduced, was sacrificed in the same manner; he alluded to the stocking machine, which was one of the most complicated, if not the most complicated piece of machinery that they had at present in use. These several subjects, including some of the newly projected forms of steam engines, he should endeavour to describe and illustrate before them in four or five successive lectures. When these were completed, if nothing more important or pressing was waiting their acceptance, then he would deliver the anatomical course which he some time since proposed laying before them.

He was requested by the committee to state, that the class of mutual in-

struction in the science of mechanics met every Tuesday at the theatre at half past eight. He would offer a few remarks on this manner of conveying mechanical information. It was proposed that on these occasions the lecture of a previous evening should be reheard, one of the most erudite becoming the lecturer. An attentive auditor who devoted a little study to what he had heard, would soon understand the application of the different principles, and would seldom fail to make out an intelligible lecture. They did not, however, propose this plan exactly. There was an individual appointed by the committee who would be a responsible person for the instruction of the class. The apparatus of the lecturer would be left on the table until this meeting had taken place; and the members would then be able to see if they could not suggest some better plan to illustrate the principles laid down by the lecturer. In this way they hoped to induce many members to contribute to the experimental apparatus of the Institution. He was quite sure there were minds amongst them that would suggest improvements in their apparatus for the purposes of illustration. As a proof that the invention of individuals would be likely to supply that which would be most useful, Dr. Birkbeck referred to a peculiar description of clock, which had been invented by two individuals, one a resident in Yorkshire, and the other a person named Dyer, an American.

He proposed introducing the rotatory loom, actually working by the aid of a steam engine, if they could succeed in getting it into the theatre; and they would then see direct and retrograde motions obtained in a manner of the greatest simplicity with which it had been yet achieved. The motion given to the fly-shuttle was unequalled for simplicity, compactness, and effect. A contemplation of these different kinds of machinery on a practical scale would be found one of the most valuable appendages to the many great means of instruction which this excellent institution had accumulated.

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## MR. TOPLIS'S SECOND LECTURE ON MECHANICS.

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On Friday, the 26th of May, Mr. Toplis delivered his Second Lecture on Mechanics. He commenced by observing, power is that which generates or has a tendency to generate motion. Power in activity is termed force, and this term has the same acceptation when so used, as in common language. Force was either continuous or momentary; and to distinguish them he would call one a force of pressure and the other a force of impulsion. The force of impulsion acted only for the moment on the body. This was shewn by the two pendent balls to which we have before referred. The force of pressure was either equable or unequable. Either the body continued to move the same during its motion, or its motion was accelerated, or diminished. The force of pressure might be intermittent, occasionally ceasing altogether. Mr. Toplis then proceeded to describe that a lathe would exemplify motion alternately accelerated and retarded; this motion was produced by intermitting force. The force of impulsion acting on a body only momentarily; it imparted its effect on the instant, and gave a given velocity to a body immediately succeeding the moment of contact. He had before stated that a body in free space would for ever continue to move with the velocity it had once acquired; but if the body which had received impulsion were opposed by the uniform resistance of any other medium, its velocity would begin to decline, and gradually abate. Motion might be derived to a body from more than one source; and from two or more sources at the same time operating on the same mass of matter. These forces might be equal or preponderating, and from this diversity resulted much difference of effect. A body under the influence of gravity would move at right angles: but if at the same time it were under the influence of some other attractive force a compound motion would result, and the diversity would be according to the influence of the two forces.

Motion did not in all cases ensue from the exertion of force. An inert body might be supposed to resist motion; but the least force in space would

impart motion to a mass of whatever magnitude. Suppose a mass in free space with no tendency to motion, such a mass in a case like this would have no weight, and the smallest force would be adequate to impart motion to it. This, however, was only hypothetical. If a body were met in an opposite direction its motion would be nullified. If two bodies in motion met with equal forces, they would destroy each other's motion at the moment of contact. Mr. Toplis endeavoured to show this by means of two pendent balls, but as they were made of lead their elasticity caused them to rebound.

A body falling to the ground might be intersected and kept suspended by a force of resistance: yet the descending mass being under the same influence on removing the suspending body it would continue its motion. In this light, quiescent pressure became a power. Mr. Toplis here allowed a body to fall upon a small stage, and on removing it the body in course fell to the ground. He explained by this that it did not follow because a body was at rest that its power was destroyed; it was still under the influence of the same power that at first gave it motion. The motion resulting from a body in free space was rectilinear; that was to say, the centre of inertia would pass along a right line; whenever the centre of inertia differed from a right line, the body must be considered as under more than one force. This was the condition of all the celestial bodies. They were aware, from the splendid illustrations and instructions of their eloquent and scientific lecturer on astronomy, that the celestial bodies moved from a right line, which was a proof that on each planet or sun more than one force was operating.

The quantity of motion generated from a body driven from a state of rest was in proportion to the force exerted. Gravity was a power considered to prevail throughout the universe. Its attractive force was in constant operation on matter proximate, or parted in inconceivable space. It was the universal property of matter; ruling and appointing the motions of bodies in their orbits; preserving their distances, regulating their spheres, and directing and keeping up motion, incessant, unjarring, and universal: it preserved creation in beauty, harmony, and order. It did not operate merely on the earth, and detached bodies on or near it: for if two light bodies were placed in water, it would be seen that at a certain distance they would attract each other, and gradually approach until they touched. Mr. Toplis exhibited this by means of two floating boats; and observed, that it was well known ships or other floating bodies attracted each other in the same way. The attraction of gravity was similar in its action to other attraction of which they had instances; these operated at sensible distances; it was similar to the action of the magnet; but this was limited to small spaces.

The attraction of gravity was a simple force acting in right lines. Mr. Toplis here exhibited a diagram, and explained that matter gravitates according to its mass. Matter at any distance had a tendency to apply itself to the earth's surface, which tendency was according to its quantity of matter; for as gravity affected all matter, the property appertained to every particle. This tendency of matter to the earth was called weight. Gravity was considered as a force tending towards a centre; that was, some point within the substance of the mass affected by it. If this was the case, right lines drawn as a radii from any single point must depart from each other; this was called divergence. When they tended towards a centre they were said to converge. This was fully exemplified by means of a diagram. It was shown that the divergence of the lines increased as the distances from the centre increased. At double the distance from the centre the lines were double the distance from each other, at four times quadruple, and so on: and it was therefore said, that the angle increased with the squares of the distance. The lines diverged in every direction from the common centre. It was explained, that as these lines diverged, the nearer the body was, the greater must be the attraction; the farther it was, the less number of lines would operate upon it, and therefore the less intense must be the attractive power. The intensity of gravity, therefore, decreased inversely as the squares of the distance.

The attractive force in all matter was reciprocal between bodies. They tended to each other in proportion to their several masses; and if there was

nothing to interrupt them they would meet at a point, the common centre of the two if they were equally balanced. The larger one would be attracted by the smaller one, and the smaller by the larger, inversely as their magnitudes. Thus the small body would move over as much more space than the large one as it contained less matter.

The force of gravity acted in right lines perpendicular to the earth's surface. All perceived when witnessing a falling body, that it tended to the centre of the earth. Gravity then was always so considered, and there would be no exception to this if the earth were a perfect sphere; but it was ascertained that if a plumb line were let down the side of a mountain of considerable magnitude, instead of hanging perpendicularly, the line would be deflected, which was a direct proof of the attractive influence of the mountain.

Gravity being a centrifugal force, it was augmented by approximation: and hence, as a body approached the earth, it acquired accelerated motion. From our not being able to get more than a few feet from the earth's surface, we had not been able to determine the comparative intensity of this power. The motion of bodies was uniformly accelerated, or its velocity increased, equally in equal times according to the body's density. To explain this part of his lecture more fully, Mr. Toplis had recourse to a very ingenious instrument, which he said was made by one of the members of the Spitalfields Institution. He had one which was the property of the London Mechanics; but it was very defective.

Gravity might not be regarded as an undisturbed force: it had to encounter the resistance of the atmosphere, and this was not of little account, it becoming more considerable with every augmentation of the velocity of the mass. The power of gravity operating equally at equal distances on all matter, must give to all the same velocity: the fact however was, that if two bodies of equal weight, but one possessing more extensive superficies than the other, had to descend, the atmosphere would materially retard the course of the latter. As an illustration of this, a glass tube was exhausted by means of an air pump, and it was seen that when there was no longer any atmosphere to operate resistingly, a piece of metal and a feather fell with equal velocity.

It was said, that in proportion to the density of the medium through which a body had to pass, so would be the resistance. Two bodies of equal weight but of different superficies were placed in water; the most dense passed through it quickly, while the motion of the other was considerably retarded.

Mr. Toplis said he should not go into the subject farther that evening.

## MODE OF PRESERVING LEMON AND LIME JUICE.

It is well known that the juice of lemons, or of limes, expressed from the fruit, will in a short time, especially if kept warm, become mouldy, and unfit for use as an article of food; and that the final result of this spontaneous change is the destruction of the acid itself. The acid may, indeed be separated from other matters with which it is naturally mixed; but in so doing all the odour and flavour of the native juice are also destroyed, for pure crystallized citric acid is wholly inodorous, and to the taste simply acid.

The effect of pure citric acid in preventing or mitigating the severity of sea scurvy is greatly inferior to the recent juice; and in many of our circumnavigations, lemon or lime juice, mixed with a small proportion of rum, about one tenth, has been found to keep for a considerable time in tropical countries, and to be very efficacious in preserving the health of the crews. In some cases, however, this addition of spirit is by no means desirable.

In April, 1824, Captain Bagnold produced to the committee a specimen of lime juice, which had been prepared in Jamaica in the preceding September, according to his directions. The juice having been expressed from the fruit, was strained, and put into quart bottles ; these having been carefully corked, were put into a pan of cold water, which was then by degrees raised to the boiling point. At that temperature it was kept for half an hour, and was then allowed to cool down to the temperature of the air. The process, therefore, was in substance, only the same as that which has been long practised in this country for preserving green gooseberries, and other fruits, for domestic use. A bottle being opened by the committee, the juice was in the state of a whitish turbid liquor with the acidity and much of the flavour of the lime ; nor did it appear to have undergone any alteration.

In March, 1825, some of the same juice, which had been examined the year before, and which had since been only again heated and carefully bottled, was laid before the committee. It was still in good condition, retaining much of the flavour of the recent juice.

Hence, it appears, that by the application of the above process, the addition of rum, or other spirit, to lime or lemon juice, may be avoided, without rendering it at all more liable to spontaneous alteration.—*Trans. Soc. of Arts.*



**CANAL OF THE PYRENEES.**—The royal canal of the Pyrenees, a plan of which has been presented to the French Government, is to continue that of Languedoc, from Thoulouse to Bayonne. The surveys are all finished, and extend over more than 70 leagues, in the whole of which line there is not a single obstacle of importance. This canal will pass through five fertile departments, the produce of which it will be the means of spreading. A free navigation from one sea to another, from the Mediterranean to the Western Ocean, will be the immediate consequence of this great undertaking.

**COMETS.**—It is now certain that the same comet has appeared in our planetary system in the years 1796, 1795, 1801, 1805, 1818, and 1825. It appears that in its course, it never passes the orbit of Jupiter. The period of its revolution (which is the shortest known) very little exceeds three years and a quarter ; and its mean distance from the sun is not more than twice that of the earth. It seems to be especially connected with the system in which our globe is placed, and crosses our orbit more than sixty times in a century. M. Olbers, the celebrated astronomer of Bremen, who has bestowed much attention on this comet, has been lately occupied in calculating the possibility of its influence on the destinies of our globe. He finds that in 83,000 years this comet will approach the earth as nearly as the moon ; and that in 4,000,000 of years it will come to within a distance of 7,700 geographical miles ; the consequence of which will be (if its attraction be equal to that of the earth) the ele-

vation of the waters of the ocean 13,000 feet ; that is to say, above the tops of all the European mountains, except Mont Blanc. The inhabitants of the Andes, and Himlaya mountains alone will escape this second deluge ; but they will not benefit by their good fortune more than 216,000,000 of years ; for, it is probable that, at the expiration of that time, our globe, standing right in the way of the comet, will receive a shock severe enough to ensure its utter destruction !!!

### LIST OF NEW PATENTS.

**FIRE-DAMP.**—To Wm. Wood, of Summer Hill Grove, Northumberland, for an apparatus for destroying the inflammable air, called "Fire Damp" in mines. April 29. Six months for enrolment.

**ELASTIC SPRINGS.**—To John P. Gillespie, of Grovesnor Street, Newington, Surry, for a new spring, or combination of springs. April 5. Six months.

**VACUUM ENGINE.**—To Samuel Brown, of Old Brompton, Middlesex, for certain improvements on his former patent, for an engine for effecting a vacuum, and thus producing powers by which water may be raised, and machinery put in motion. April 25. Six months.

**WIND GUARD.**—To Francis Halliday, of Ham, Surry, for a machine to prevent the inconvenience arising from smoke in chimnies, which he denominates a "wind guard." April 25. Six months.

**SHIPS' HEARTHES.**—To John Williams, of the Commercial Road, Middlesex, for certain improvements in ships' hearths, and apparatus for cooking by steam. April 27. Two months.

**BRICK MAKING.**—To Wm. Choice, of Strahan Terrace, and Robert Gibson, of White-Conduit Terrace, Islington, for certain improvements in machinery for making bricks. April 27. Two months.

**CUPPING.**—To Charles Kennedy, Great Dover Road, Surry, for improvements in the apparatus used for cupping. April 29. Six months.

**SPINNING.**—To John Goulding, late of the U. S. of America, but now of Cornhill, London, for improvements in machinery for carding, roving, spinning, &c. May 2. Six months.

**STEAM ENGINES.**—To A. Buffum, of Jewin Street, and John M'Curdy, of Cecil Street, Strand, for improvements in Steam Engines. May 6. Six months.

### TO OUR READERS AND CORRESPONDENTS.

M. S—D's invention has already been the subject of two or three patents, of which he is doubtless not aware : he may find an account of one of them in the Repertory of Arts for June, 1818.

In reply to J. D. a description of Wolfe's Distilling Apparatus is to be found in every modern chemical work, it would therefore be improper to give it insertion in our work, which is almost exclusively devoted to new inventions, that have not been published before. J. D. will however see in our next a description of a recently patented still, which may be considered as a great improvement upon Wolfe's apparatus.

We thank "A Member of the London Mechanics' Institution" for his advice, by which we shall be influenced.

From unavoidable causes, our usual chapter on the Steam Engine by Mr. Galloway, is postponed until next week. Those of our readers who are desirous to possess this valuable treatise in a separate form, may have the two first numbers (price 6d. each) on application to the undermentioned booksellers.

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# REGISTER

OF

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J. J. SAINTMARC'S PATENT STILL.

VOL. IV.

2

## J. J. SAINTMARC'S PATENT STILL.

**FIGURE 1.** represents a sectional view of the Still with its furnace, and an outside view of part of the refrigerator or worm-tube. The Still is a column, or cylinder, consisting of ten coppers, or boilers, surmounting each other. Figure 2, is a perspective view of one of the double tubes, or pipes; and Figures 3 and 4 are plans of two portions of the Still, hereafter described.

*Fig. 1.* The ten coppers, or boilers, surmounting each other, constituting the still, are numbered 1 to 10.

*a* the furnace, above which the still is placed.

*b* openings, or manholes, tightly closed by screw boxes, or otherwise, calculated to admit a person into the several coppers No. 1 to 9 inclusive, for the purpose of cleaning or repairing them.

*c* are seven curved pipes, furnished with cocks, communicating, respectively, from one copper to that next below, so that the wash introduced into the copper No. 8, is conveyed into the seven lower coppers, until they are sufficiently filled.

*d* the supply pipe, communicating from the wash-charger to the still; which is furnished with a cock, for the purpose of turning on the wash into the copper No. 8, being the highest of the coppers which is charged with the wash.

*e* eight small pipes furnished with trial cocks, which, on being turned, indicate when the several coppers are charged to the proper height, as denoted by the dotted lines on the same level as these pipes and cocks.

*f* a small proof cock, placed vertically near the roof of the copper No. 1, which, on being turned, determines, by the application of a lighted taper, or candle, whether or not there remains any portion of alcohol in this copper or boiler.

*g* a discharge pipe and cock, to carry off the spent wash from the copper No. 1, when the spirit is distilled from it.

*h* ten double tubes, or pipes, (of which six only can be shewn in the section) five are fixed on the roof of copper No. 1, and five on that of No. 2. The vapour produced from the wash in copper No. 1 passes through the five double tubes on the roof of that copper into the copper No. 2, by rising up the inner tubes *a*, passing therefrom through the vertical slits or openings *c*, at the upper part thereof, and descending down the outer tubes *b*, discharging itself into the liquid in the lower part of the copper No. 2. In like manner the vapour produced in the last mentioned copper passes up the double tubes on the roof thereof, into the copper No. 3. (*For a better description of these double tubes, vide the perspective view of one of them in Fig. 2; and for the plan of the coppers containing them, vide Fig. 3; and their respective explanations given below.*)

*i* seven caps, or semi-circular vessels, (in French, *calottes*,) constructed upon, and tightly jointed to, the centres of the roofs of the several coppers No. 3 to 9. These caps are surrounded with wash, but have internal communication only with each other in the manner hereafter shown.

**k** seven double tubes, or pipes, (of the same kind as those marked **k** already described,) the lowest of which is tightly fixed on the centre of the roof of the copper No. 3, and the remaining six are tightly fixed to the centres of the six caps contained in coppers No. 4 to 9, as well as in the roofs of the coppers next above, through which they respectively pass. The vapour described above to have reached the copper No. 8 becomes mixed with the wash contained therein. The vapour generated in this copper passes through the double tubes into the cap which encloses it, and so, in succession, through the several tubes and caps above, until it reaches the cap on the roof of the copper No. 9, whence it finally passes off into

**l** a large pipe, which conveys it to

**m** a worm-tub, or refrigerator, (of which an outside view only, is given in the drawing,) through the worm contained therein, and runs it off as alcohol at the bottom thereof, by

**n** a spirit pipe, which conveys it to the spirit receiver. (*For the plan of the coppers containing the caps i and double tubes k above described, as well as the reverted double tubes o, and the safety pipes v, both hereafter described, vide, Fig 4, and the explanations of it given below.*)

**o** seven reverted, or descending double tubes, (constructed on the same principle as those already described, but of smaller diameter,) which are suspended, reversed, from the roofs of the several coppers from No. 9 down to No. 3. Of these reverted tubes, the six uppermost pass through the domes of the caps i, to which they are tightly fixed; and they serve to return to the lower caps, or vessels, in succession, the phlegms, or such results of the vapour, in a liquid form, as may have been condensed in its passage upwards through those several caps. These phlegms, or condensed liquids, are partially re-distilled in their progress; and the remainder pass through the seventh, or lowest, of these reverted tubes into the copper No. 8, where they become mixed with the wash contained therein, and are again distilled with it.

**p** a pipe and cock for the supply of cold water into the copper No. 10, from whence it passes into copper No. 9, through the circular openings.

**q** in the roof of that copper. These openings also serve for the escape of whatever steam may be generated when the surface of the water is lower than the roof of the copper No. 9.

**r** a manhole, or opening, in the summit of the apparatus, which is never closed. It serves for the purpose of clearing the upper part of the apparatus, and for the free escape of the steam generated by the water, in either of the two coppers No. 9 or 10.

**s** a small pipe and cock placed near the top of the uppermost copper No. 10, to carry off the heated water from the surface, in proportion as the water pipe **p** furnishes cold water.

**t** a small pipe and cock of the same description as **f**, placed near the top of the copper No. 9, for carrying off the heated water, when it is found expedient to limit the supply of water to that copper, and

to exclude it from the highest. These two pipes (*s* and *t*) fall into the pipe

*u*, which, with its cock, is placed at the bottom of the copper No. 9, for the purpose of drawing off the water from the coppers No. 9 and 10 at pleasure.

*v* four safety pipes, fixed in the roofs of the several coppers; No. 4, 5, 6, and 7, which are intended to carry off such vapours as may rise from the wash in those coppers, and conduct it to

*w* a pipe which passes on to the refrigerator, G, and by a separate worm, terminating at

*x* runs off the small portion of spirit it produces into the spirit-receiver.

*y* a pipe and cock by which a stream of clear water may be thrown into the uppermost of the caps *i*, and thence descend through the other caps below, in order to cleanse them from impurities.

*Fig. 2*, (referred to before) shows by a perspective view the construction of the double tubes; part of the outer tube *k* is broken away to exhibit the slits, or openings, that are made vertically in the upper part of the inner tube *s*. Through these openings the vapour that rises up the inner tubes *s*, enters the outer one *b*, and, passing down that pipe, discharges itself into the bottom of the liquid.

*Fig. 3*, gives a plan of the boilers No. 2 and 3, with the five double tubes before mentioned.

*Fig. 4*, is a plan of the boilers, from No. 4 upwards, shewing the semi-circular cup and the several tubes before-mentioned.

*Observations by the Patentee.*—"After explaining the construction of the apparatus, it may be necessary to give an idea of the principles on which the incontestable advantages to be derived from it are founded.

"The ten coppers placed one upon the other, of which the eight lowest are intended to hold the wash, and the two upper ones to receive water,—distil in the following manner:—

"The three first, of which the second and third alone are intersected by the double pipes, distil almost at the same time. The lowest, only, being submitted to the immediate action of the fire is, consequently, the first whose wash enters into a boiling state. The vapour penetrates into the second, passing through the wash which is contained in it, by means of the above-mentioned pipes; and is there condensed, yielding up its caloric to that liquid, which is thereby quickly brought into a boiling state; the vapour which proceeds from the wash in the second boiler passes into the third, producing the same effects as in the preceding. The new vapour, necessarily stronger than the first, rises and passes into the fourth, where it is received under a semi-circular cap, (or *calotte*), which prevents it from communicating directly with the cold wash contained in that copper.

"On arriving in this cap, it is easily conceived that the most watery portion of the vapour is there condensed, giving up its caloric, which contributes to heat the wash that surrounds the cap. The

most spirituous part, which passes into the cap of the fifth copper, experiences the same effect on coming in contact with a cold body. The same operation takes place from one cap to another up to the last. As the vapour which rises arrives in a cold atmosphere, it is condensed, ceding its caloric; and it is after a succession of sufficient condensations, that the spirit is divested of all weak and watery particles, which, thus liquified, return from one cap to another, being partially re-distilled in their progress, according to their degree of gravity, until the least spirituous reaches the third copper, there to undergo a new distillation. It has been observed, that the two upper coppers are reserved to contain cold water; it is by this means, and by renewing this water, keeping it at a higher or lower temperature, according to circumstances, that the distiller can obtain the spirit at the strength he desires.

“ To explain by what physical law the watery vapour is forced to return from cap to cap to the third copper, and is there found totally separated from the alcohol, which arrives at the worm pure and free from any empyreuma, we shall call to mind, what all distillers are, doubtless, aware of. It is known that water cannot boil under a heat of 212 degrees of Fahrenheit; while alcohol boils at about 173 degrees. It is evident that, whenever the watery and alcoholic vapours rise, and are successively received in one or more atmospheres of from 174 to 190 degrees, the watery vapour becomes separated from the alcoholic, and is condensed; and the last, only, passes out, and is received at the desired strength; having a care to regulate properly the temperature of the water contained in the two uppermost coppers, which are traversed by the strongest or most alcoholic vapour before it passes into the worm.

“ It may be affirmed that the advantages of this apparatus are the greatest that have, as yet, been obtained. There is a great economy in fuel, as well from the small surface exposed to the action of the fire, and productive employment of every portion of the caloric, as by the simplicity and rapidity of the operation.

“ It will be perceived that a large portion of the spirit is distilled by vapour; and is, consequently, much purer than that obtained by the ordinary apparatus. In fact, only the first charge of the lowest copper is entirely distilled by the direct action of the fire; for the watery and alcoholic vapours, which rise together, on arriving in the second, become mixed with the wash contained in it, and are re-distilled, before they pass into the third copper. It is easy to conceive that, when the first copper has furnished all the alcohol it contains, the wash of the second is chiefly distilled, and the remaining portion, which is conveyed into the first, is submitted to the immediate action of the fire during so short a time that it cannot acquire a bad taste.

“ By these details, it may be seen that the distillation is really effected in the three first coppers. The wash contained in the coppers with the caps is prepared to be distilled immediately after its descent into the third copper. In imbibing the caloric brought by the vapour, which is continually renewed, the wash in the fourth

and four succeeding coppers becomes the first agent which contributes to divest the alcohol of the watery parts which rise with it.

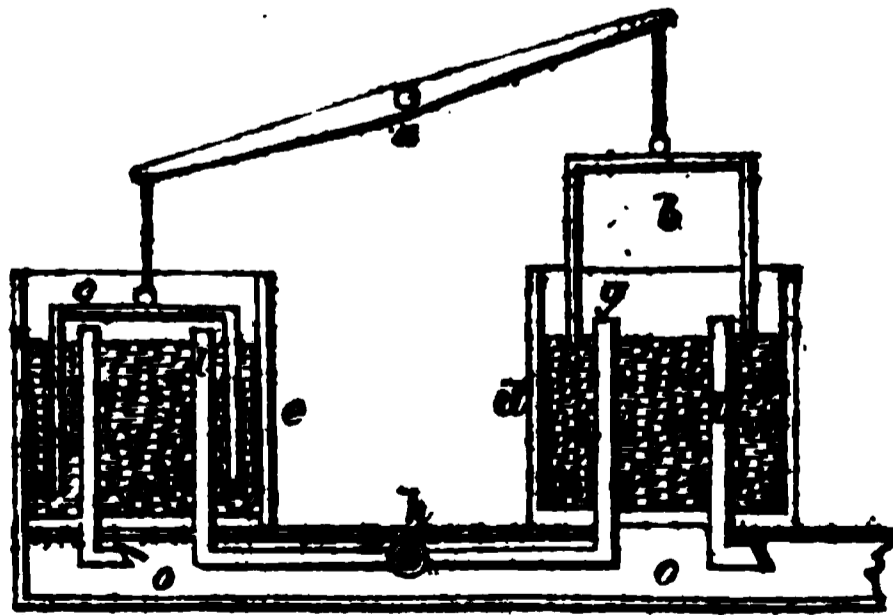
"The successive renewal of the vapour heats to such a degree the wash contained in the fourth, fifth, sixth, seventh, and eighth coppers, that it distils a small portion of it. It is for that reason, and as safety pipes, that, from the lowest to the uppermost of these five coppers, pipes have been introduced which communicate with a separate worm, to receive this spirit separately, if thought proper; not that it is of an inferior quality, but because it is not of the same strength."

*8, King's Arms Yard,  
Coleman Street, London, May, 1826.*

Patent granted to Simon Broadbent, of Abergevenny, Engineer,  
for APPARATUS FOR EXHAUSTING, CONDENSING, OR PROPELLING AIR,  
SMOKE, GAS, OR OTHER AERIFORM PRODUCTS.

THIS invention consists in the application of some very simple machinery for the purpose of exhausting or withdrawing air, smoke, gas, and other aeriform products, generated in the process of distillation, and by thus removing the pressure, producing a draught or current of atmospheric air through the fire-place, for the combustion of the fuel, and from thence up the chimney; also, in afterwards propelling the aeriform fluids withdrawn, so as to blow the fire of the furnace, or in otherwise disposing of it through flues or channels, as may be found desirable.

There are three forms of apparatus described in the specification, but the patentee states that he does not confine his claim to these particular arrangements, but to every mode of applying the principle of exhaustion caused by raising a vessel inverted in water or other suitable liquid.\* The first of these three forms is shewn in the annexed diagram.



In the above figure (which is a vertical section) *a* is the fulcrum of a lever or beam, with two inverted vessels, *b* and *c*, suspended to

\* In claiming so much, we think the patentee has been badly advised, as blowing machines and pumps have long since been made on similar principles.—Ed.

its extremities; these vessels are open underneath, but air-tight above: *d* and *e* are two larger vessels, filled with water to the same level, into which *b* and *c* respectively ascend and descend: *g h i* is a tube or pipe, which passes through the vessels *d* and *e*, and reaches above the surface of the water; at the extremities are two valves which respectively open outwards into the inverted vessels, with a pipe at *h* connected to the fire or furnace, where the exhaustion is to be effected. *k* and *l* are separate pipes passing through the bottom of *d* and *e*, and extending a little above the surface of the water; they are open at top, and have valves at the bottom opening into the trunk *o o*, for carrying off the gas or smoke.

An alternating motion being imparted to the beam, by a steam engine or other first mover, the air, smoke, or gas, passes up the tubes *g h i*, and fills each inverted vessel as they are successively drawn up out of the water; the descent of the inverted vessels closes the valves at *g* and *i*, and opens those at the bottom of the tubes *k* and *l*, through which the gas or smoke is driven forward into the trunk *o o*, and thus, by the reciprocation of the beam, a continual blast or stream of gas is produced in the trunk *o o*, to be applied as circumstances may require.

The subjoined figure represents another arrangement of the apparatus for situations where a motive engine cannot be applied, and where it is desired that the operation may be conducted slowly and regularly.

In this case the inverted vessel is suspended by a chain or rope passing over a pulley with a sufficient weight at the other extremity, to raise the inverted vessel, and thus perform the operation of exhaustion. *a* is the inverted vessel, *b* the tank, filled with water as shewn; *d* is the outlet pipe, having a valve opening outwards at the bottom. *e* is the inlet pipe, having a valve opening at top into the inverted vessel. When the inverted vessel is full of air, gas, or other elastic fluid, the weight *f* must be diminished, when the vessel by its own weight will propel the air contained therein, through the tube *d*, and, opening the valve at bottom, it will be driven forward in a current to the point desired.

The annexed figure shews the third mode described by the patentee. *a* is an air-tight vessel closed on all sides, containing water to the height shewn; the inverted vessel *b* is connected to a vertical rod *c*, which works through a stuffing box: *d* is an inlet pipe, with a valve opening into or towards the vessel *a*: *e* is an outlet pipe, with a valve opening into the interior of the trunk *f*: *g* is the outlet pipe to the inverted vessel, and *h* the inlet pipe to the same, each having a valve as shewn, and described in the previous arrangements. By

this contrivance it will be seen that, by the alternating action of the rod *c*, a partial vacuum will be effected both in the inside of the inverted vessel and in the upper part of the closed vessel, causing thereby a continuous exhaustion in the pipes or tubes connected thereto, and subsequent propulsion of the air or gas extracted, into the trunk *f*, by which it is conducted to its destination.

## History of the Steam Engine.

### CHAPTER III. *continued.*

*Contents.*—WATT'S SEMI-ROTATIVE ENGINE.—WATT'S ROTATIVE ENGINE.

We have likewise some information on the subject of Mr. Watt's experiments on rotative engines, by Mr. Farey, (in his article Steam Engine, which is to be found in Rees's Cyclopaedia,) who says, "One of his first trials was uncommonly ingenious; it consisted of a drum turning air-tight within another, *with cavities so disposed*, that there *was a constant and great pressure urging it in one direction*; but no packing of the common kind could preserve it air-tight with sufficient freedom of motion. He succeeded by immersing it in mercury, or in an amalgam, which remained fluid at the heat of boiling water, but the continual action of the heat and steam, together with the friction, soon oxydated the fluid and rendered it useless. He then tried Parent or Barker's Mill, enclosing the arms in a metal drum, which was immersed in cold water. The steam rushed rapidly along the pipe which was the axis, and it was hoped that a great reaction would have been exerted at the end of the arms, but it was almost nothing. It was then tried in a drum kept boiling hot, but the impulse was very small in comparison with the expense of the steam."

The former part of this extract is about as obscure as the specification which we have just noticed. We should certainly have expected from a man of Mr. Farey's experience a somewhat clearer account of any experiment than that with which we are furnished; for to say there "was a machine with cavities so disposed that there was a constant and great pressure urging it in one direction," conveys no further idea than that a motion was *somehow* obtained, but how, it is utterly impossible to know. The amount of this extract is, that Mr. Watt tried a great number of experiments in order to obtain a rotatory engine, and that in these experiments he failed. The information we gather from Mr. Farey might have been said in as few words.

The second patent of 1782 (for there were two patents of that year, one in February and the other in July) describes a rotatory, and semi-rotatory, or reciprocating rotatory engine. To the rotatory engine we shall first direct the attention of the reader.

*c c* is a cylinder of any given dimensions, say a foot deep, and three feet diameter. *a* is an axle, passing through stuffing boxes in each lid or end of the cylinder. *b* is the piston packed at the ends

which rubs against the cylinder, and at the sides which rub against the lids, which are previously turned; the form of this piston, therefore, is square, packed on three sides, and fixed to the axle *a* on the fourth. *e* is a valve or flap, which turns upon a joint or pivot *f*: the concave side is a segment of a circle of the same radius with the cylinder.

It extends the whole length of the cylinder, is packed on its sides, and when shut back into the cavity *d*, becomes, as it were, a part of the cylinder: completing the circle, which is imperfect when the valve is in its present situation. *g* is the pipe for admitting the steam from the boiler, and *h* the pipe for allowing it to escape into the condenser.

Steam being admitted from the boiler through *g* presses equally upon *e* and *b*, but *e* being stopped against the axle, the piston *b* recedes from the pressure, and turns the axle *a* and a heavy fly wheel round with it. The piston continues in motion until it comes in contact with the lower side of the valve *e*; where it would stop but for the impetus of the fly wheel, which urges it forward, and it strikes the valve *e* into the recess *d*, and moves round until it passes *g*, when the valve, either by a lever or by its own gravity, resumes its present situation, and the piston receives the action of the steam as before.

This plan, we are informed, was never carried into execution, and we must, therefore, as in other instances, endeavour to trace the objections from subsequent experience, but there have been so many schemes closely resembling this, that these are easily ascertained. The principal objection appears to be that it would be liable to derangement, as the violence with which the valve would be alternately driven into the recess, and upon the axle, would speedily shake the machine to pieces; besides which, it would be impossible for the packing used in the reciprocating engine to pass over the pipes *h* & *g*,

without being torn up and rendered useless. A great waste of steam must likewise take place whilst the piston is passing over the surface of the valve: for at that time the steam pipe *g* has a free communication with the eduction pipe *h*; and every one acquainted with the subtle nature of steam must be aware that as much steam would thereby escape, without producing any effect, as would have been sufficient to work an engine free from that defect. This last objection might be obviated by shutting off the steam during that part of the revolution; but the specification proposes no such method, and we are not authorized to make any gratuitous addition.

The semi-rotative engine next comes under our notice. *d'd* is the interior of the cylinder, similar to the last. It is likewise fitted with a piston *h*, packed in the same manner. *c* is a projection of metal extending from the circumference to the axle *a*. Packing is introduced between this projection and the axle, so as to prevent the steam from escaping between them. *e f* are two valves which admit steam from the steam pipe *g* into the cylinder on each side of *c* alternately. *e f* are two valves for changing the direction of the steam: *i j* are two valves acting in conjunction with *e f*, so as to open or shut off a communication with the condenser *l k* through the pipe *h* at the proper time. Levers are attached to the rods by which these valves are worked, from tappets on the pump rods *r q*.

Steam, as admitted from the boiler through the pipe *g* into the steam-chest, and finding the valve *f* open, rushes up the pipe; and so into the cylinder between the piston and stop *c*. The piston, receding from the pressure, drives the air in the cylinder through the

other pipe, and down through the valve *j*, into the condenser, whence it escapes by the pump *l*. It continues revolving until it comes in contact with the other side of *c*, when it is stopped; but previous to this the valves *f* and *j* have been shut by their respective levers, whilst *c* and *i* have been opened. The steam has now access through *c* to the other side of the piston, and turns it in the contrary direction; the steam which last performed its office escaping down through *i* to the condenser. The first operation is then repeated, reversing the motion of the piston as soon as, or before it comes in contact with the other side of *c*. *a* and *m* are two toothed wheels attached to the axle *s*, which work (as shewn) by racks, the pump rods *e* and *p*, and the smaller pump rods *q* and *r*. The former *e* and *p*, are supposed to draw water from a mine, but the smaller ones only work the condensing pumps *k* and *l*.

This is, really, a clever machine. It was never, we understand, carried into execution, but why, we can scarcely tell. It would hardly be an objection that the piston would strike against the stop *c* and thereby shake itself to pieces: for here as an equable motion is not required like a rotatory engine, the speed might (as in all pumping engines which were liable to the same objection) be gradually retarded, so that the impetus would be destroyed before it came in contact with the stop. Perhaps the most solid objection would be that of the packing requiring more care than a common workman, such as generally attends to steam engines, would be able or willing to bestow; but if this were found a conquerable objection, we can scarcely conceive a reason why it should not have had a fair trial. It would have been extremely portable and cheap, would have occupied very little room, and the friction would have been comparatively trifling.

[To be continued.]

## **London Mechanics' Institution,**

FRIDAY, 24 OF JUNE, 1833.

### **MR. TOPLIS'S THIRD LECTURE ON MECHANICS.**

On Friday evening Mr. Toplis delivered his Third Lecture on Mechanics. Mr. Brougham was the president of the evening. On his presenting himself he was warmly applauded.

Mr. Toplis commenced by observing, that when Galileo propagated the result of his observations on the planetary system, bigot power dragged him before the Inquisition to make him retract what was considered a damnable heresy; and at the age of 70 he was compelled to pronounce his belief, that the earth stood fixed in space, as the centre of the universe, round which the planetary system performed its diurnal rotation. The iron band, however, that crushed him could only command his feeble voice, and it was said not even that altogether, for we had it reported, that when he was raising himself from off his knees, he could not refrain from pronouncing in an under tone, "But it does not."

Such was the genius of the rulers of that day: thus did they deal out science with a niggard hand. But this arrogant usurpation was as blind as unprincipled. It forgot, that its effort to stop the progress of science were

useless ; that it was child's play to attempt to bank up the waters : it perceived not that, hereafter, as at this moment, the wide-spreading wave of knowledge would roll over the surface of the earth, and fertilize that which had before been barren.

Copernicus himself, who lived a century before Galileo, was fearful of encountering the prejudices of the age in which he lived, though he saw that the system of Pythagorus could alone be maintained on scientific grounds. He called to his aid the principles of mathematics, made his calculations, arranged his arguments, and composed a work. After a lapse of 40 years he ventured on its publication, committing it to two friends ; and it was only two years preceding his death that the first copy was placed in his hands. This was an hour when the shafts of malignity would have lost their poison. At this day mathematics constituted almost the only instrument of philosophy.

The philosophers of Europe continued to busy themselves with various systems : but truth was not satisfied until Newton solved the great problem. In the year 1665, when the plague spread consternation throughout the country, he retired from the busy and afflicted world, and his mind being habituated to abstruse inquiry, it was led to advert to the cause and laws of motion in the celestial bodies. He asked, may not this same power appertain to the moon : he had recourse to the proof of calculation, and his proof failed. A few years after, however, he resumed his inquiry, and succeeded in demonstrating his principle of harmony : he found that there was an universally attracting force operating on all matter inversely as the squares of the distance, and he called this gravitation. Newton's mind could not contemplate without anxiety the progress of his solution : it was said, as he approached the end, he was obliged to request the assistance of some friends. A proof of a similar excitement was afforded by Pythagorus ; who, as the solution of one of his problems advanced became so affected, that in a moment of exultation he vowed to sacrifice to the gods a hundred oxen should he succeed ; these emotions were of the highest possible order ; they were evidences of the greatest refinement of which human nature was susceptible.

Speaking of the force of gravitation in the last lecture, he exhibited to them by means of an imperfect instrument, the acceleration of falling bodies, and it was said, that a body fell through twice the space in the second interval of time that it has fallen in the first. There was a fallacy in the experiment which he would point out to them. They were aware that the moving force, as was then stated, was the power of gravity, and the bodies exhibited were placed in equipoise, so that there was no more force acting on one than on the other. They should be told, however, that when the bodies were balanced, the gravitating power had to call into motion the bodies then at rest ; it had to overcome their inertia. This, though not considerable, was something ; the first second of time must be amassed before motion was perceptible. There was another source of fallacy : the cord to which the two bodies were attached bore a perceptible weight compared with the two masses of matter that were balanced ; this cord when action commenced would preponderate ; and however light it might be, would influence a delicate instrument. Under these circumstances, it would not do to apply the results furnished by this instrument to the natural tendency of falling bodies.

Mr. Toplis then proceeded to point out the different densities of matter. The arrangement of particles in a cube of metal must be very different from that of a cube of wood ; but this principle of structure was beyond our powers of vision. This arrangement had more to do with the density of a mass than any difference in the particles. Density was more the effect of the strength of the cohesion. He should proceed to show one solid mass might contain less matter than another. He could not unite particles in an aggregate number as nature did ; but he would exhibit to them a glass of spheres, and the glass must operate as the attractive force for the purpose of uniting them. Mr. Toplis here explained that here was a mass of a certain bulk ; now without increasing this bulk he could pour in some smaller globular masses, which would fill up the interstices ; and, further, the interstices of these smaller masses could be occupied by water. The density of the water

might be increased without any augmentation of its bulk by dropping some saline matter into it; and this might be even yet carried further by the introduction of some other.

To return to the doctrine of forces, the particles of all bodies more or less change their position on being operated upon by collision. In some bodies the particles resume their primitive shape, and these are called elastic substances. The moment a compressing force were removed from a bladder filled with air, it would resume its former shape. There were bodies, such as clay, that did not possess this power of rectification. There were some hard unyielding bodies, such as marble, stone, glass, or metal: but to all of these was the power of elasticity assigned. To show the elasticity of bodies, Mr. Toplis struck a ball of ivory on a piece of marble coloured. If neither the marble nor the ivory had been elastic, the latter would only have received the colour at the geometrical point, but as it was, it covered a much larger space.

Mr. Toplis then proceeded to show that, if two elastic substances came in contact from equal distances, they would throw each other back nearly to the point from which they started. If a body in motion came in contact with one at rest, it would give to the latter all its impetus; and if several bodies intervened, the impetus would be imparted to the last. This would not be the case in inelastic bodies, such as clay or putty.

It had been said, that all simple bodies acted in right lines, and imparted rectilinear motion to the bodies: but a body might be acted upon simultaneously by several forces. If a mark were operated upon by two causes, having different lines of motion, it could not obey either of them in an undisturbed direction, for while impelled in one line by one cause, it would be drawn from it by the other. The question then was, what course would it take? There was a simple rule: motion might be represented by lines; and this would not only represent the pressure or impulse, but would show the direction of a body. Mr. Toplis here exhibited a diagram and explained, that a body under the influence of two forces, will describe the diagonal of a parallelogram. With these remarks, Mr. Toplis closed his present lecture.

## VOLCANO IN THE SANDWICH ISLANDS.

In Mr. Ellis (the Missionary's) Narrative of a Tour through Hawaii, or Owhyhee, lately published, he gives a very interesting description of a great volcano which he visited in that island. Our limited space does not permit us to give an extract of the whole; we shall, therefore, confine ourselves to his account of the *crater*, which alone exhibits a scene so stupendously awful of one of these great laboratories of nature, that we cannot forbear giving it a place in our columns.

—"The steep which we had descended was formed of volcanic matter, apparently a light red and grey kind of lava, vesicular, and lying in horizontal strata, varying in thickness from one to forty feet, In a small number of places the different strata of lava were also rent in perpendicular or oblique directions, from the top to the bottom, either by earthquakes, or other violent convulsions of the ground connected with the action of the adjacent volcano. After walking some distance over the sunken plain, which in several places sounded hollow under our feet, we at length came to the edge of the great crater, where a spectacle, sublime and even appalling, presented itself before us—

‘We stopped and trembled.’

Astonishment and awe for some moments rendered us mute, and, like statues, we stood fixed to the spot, with our eyes rivetted on the

abyss below. Immediately before us yawned an immense gulf, in the form of a crescent, about two miles in length, from north-east to south-west, nearly a mile in width, and apparently eight hundred feet deep. The bottom was covered with lava, and the south-west and northern parts of it were one vast flood of burning matter, in a state of terrific ebullition, rolling to and fro its 'fiery surge' and flaming billows. Fifty-one conical islands, of varied form and size, containing so many craters, rose either round the edge or from the surface of the burning lake. Twenty-two constantly emitted columns of grey smoke, or pyramids of brilliant flame, and several of these at the same time vomited from their ignited mouths streams of lava, which rolled in blazing torrents down their black indented sides into the boiling mass below.

"The existence of these conical craters led us to conclude, that the boiling cauldron of lava before us did not form the focus of the volcano; that this mass of melted lava was comparatively shallow; and that the basin in which it was contained was separated, by a stratum of solid matter, from the great volcanic abyss, which constantly poured out its melted contents through these numerous craters into this upper reservoir. We were further inclined to this opinion, from the vast columns of vapour continually ascending from the chasms in the vicinity of the sulphur banks and pools of water, for they must have been produced by other fire than that which caused the ebullition in the lava at the bottom of the great crater; and also by noticing a number of small craters, in vigorous action, situated high up the sides of the great gulf, and apparently quite detached from it. The streams of lava which they emitted rolled down into the lake, and mingled with the melted mass there, which, though thrown up by different apertures, had perhaps been originally fused in one vast space.

"The sides of the gulf before us, although composed of different strata of ancient lava, were perpendicular for about four hundred feet, and rose from a wide horizontal ledge of solid black lava of irregular breadth, but extending completely round. Beneath this ledge the sides sloped gradually towards the burning lake, which was, as nearly as we could judge, three hundred or four hundred feet lower. It was evident, that the large crater had been recently filled with liquid lava up to this black ledge, and had, by some subterranean canal, emptied itself into the sea, or upon the low land on the shore. The gray, and in some places apparently calcined sides of the great crater before us; the fissures which intersected the surface of the plain on which we were standing; the long banks of sulphur on the opposite side of the abyss; the vigorous action of the numerous small craters on its borders; the dense columns of vapour and smoke, that rose at the north and south end of the plain; together with the ridge of steep rocks by which it was surrounded, rising probably in some places three hundred or four hundred feet in perpendicular height, presented an immense volcanic panorama, the effect of which was greatly augmented by the constant roaring of the vast furnaces below."

## SOCIETY OF ARTS.

The annual distribution of prizes of the Society of Arts, took place on Monday last, at the King's Theatre, by the president, the Duke of Sussex, who accompanied each prize with some suitable observation. Amongst which will be found the following.

## IN MECHANICS.

1. T. Collett, upper Graystoke-place, Fetterlane—shears for making tags for laces; silver Vulcan medal.
2. G. Hooper, 1, Bury-street, Chelsea—builder's level; 5 guineas.
3. C. Hartley, 4, Essex-street, Battle-bridge—hand-rail sector; large silver medal.
4. W. Spencer, Ordnance-place, Chatham—improved method of letting go an anchor; gold Vulcan medal.
5. E. Carey, Bristol—improved dead eyes for shipping; silver Vulcan medal.
6. Mrs. H. Goode, Ryde, Isle of Wight—blind for circular-headed windows; silver Vulcan medal.
7. J. Skinner, 81, New Park-street, Southwark-bridge—improved stage-coach; 30 guineas.
8. The same—trap for vermin; 5 guineas.
9. J. Jenour, jun. 31, William-street, Hampstead-road—a shot cartridge; 15 guineas.
10. J. Adcock, 24, Leman-street, Goodman's-fields—adjustable door lever; silver Vulcan medal.
11. J. T. Towson, Devonport—banking for a chronometer; silver Vulcan medal and 10 guineas.
12. W. Palmer, Clifton-street, Finsbury—improved ruling machine for engravers; large silver medal.
13. D. Magson, 26, Harp-alley, Fleet-street—valve and stand-pipe for water mains; 5 guineas.
14. G. Edwards, Lynn, Norfolk—levelling and surveying instrument; gold Vulcan medal.
15. C. Fay, 35, Piccadilly—forceps for dentists; large silver medal.
16. J. D. Holmes, Old Fish-street—craniotomy forceps; gold Vulcan medal.
17. J. P. Clark, 5, King-street, Holborn—improved cupping apparatus; silver Vulcan medal.
18. J. Goodwin, esq. clerk of the stables, Carlton-palace—table for veterinary operations; gold Vulcan medal.
19. S. Williams, 2, Stone-stairs, Ratcliff—drag for drowned bodies; silver Vulcan medal and 5 guineas.
20. R. Cowen, esq. Carlisle—apparatus to carry off the dust produced in dry grinding; large gold medal.
21. J. Alderson, 4, Bridge-row, Pimlico—instrument for describing arcs of circles, the centres of which are not given; 10 guineas.
22. M. A. Alderson, Manchester—set of working drawings of a steam engine; 30 guineas.
23. P. Henry, Limehouse—set of working drawings of a boat steam engine; 20 guineas.

*The thanks of the Society have been presented to the following gentlemen, and their respective communications have been directed to be inserted in the next volume of the Society's Transactions:—*

B. Donkin, esq. chairman of the committee of mechanics, for a German boring bit, and a French drawing pen.

G. Mainwaring, esq. Marsh-place, Lambeth, for a working drawing of an hydraulic pressure engine erected by him at Whitby.

## IN CHEMISTRY.

24. J. H. Abraham, Sheffield—mode of neutralizing magnetism in the balances of watches; large silver medal.

25. J. Roberts, St. Helen's Lancashire—improved safe lamp for miners; silver Vulcan medal and 10 guineas.

26. J. Cathery, 6, Hyde-street, Bloomsbury—mode of coloured etching on ivory; 5 guineas.

27. W. Cooke, jun. 5, Seymour-street, North Clarendon-square—improvements in etching on steel; gold Isis medal.

28. W. Humphrys, 65, Charlotte-street, Rathbone-place—menstruum for etching on steel-plate; gold Isis medal.

### LIST OF NEW PATENTS.

**RIDS FOR MASTS.**—To Sir Robert Seppings, of Somerset House, for improvements in the construction of rids, or apparatus for striking top masts, &c. May 6. Six months.

**CHIMNIES.**—To Wm. Fenner, of Bushell Rents, Wapping, Middlesex, for improved apparatus for curing smoky, and cleansing foul chimnies. May 6. Six months.

**OPTICAL INSTRUMENTS.**—To A. Allard, De La Court, of Great Winchester Street, for improvements in certain well known instruments, applicable to the organ of sight. May 6. Six months.

**CLOGS AND PATTENS.**—To Joseph Schaller, of Regent Street, for improvements in the construction of clogs, pattens, &c. May 6. Six months.

**WASHING.**—To Edward Heard, of Shoreditch, London, for certain compositions to be used for the purpose of washing in sea or other water. May 8. Six months.

**FUEL.**—To Levy Zacchariah, Jun. of Postea, for a combination of materials to be used as fuel. May 8. Six months.

### MONTHLY LIST OF EXPIRED PATENTS.

**GUNS AND PISTOLS.**—To Joseph Manton, of Davies Street, Hanover Square, for improvements in guns and pistols :—expired April 30, 1826.

**IRON BEDSTEADS.**—To J. T. Thompson, of Long Acre, for improvements in the making of iron bedsteads :—expired April 30, 1826.

**ELASTIC HATS.**—To Thomas Dollman, of St. James's, Westminster, for an elastic round hat, that may be made out of beaver, silk, or other materials :—expired May 5, 1826.

**TIMBER.**—To George Smart, of Ordnance Wharf, Westminster Bridge, for a method of preparing timber to prevent the same from shrinking :—expired April 5, 1826.

**WATER-PROOF HATS.**—To Bassett Burrows, of Birmingham, for a method of manufacturing water proof hats :—expired May 5, 1826.

**STEAM BOATS.**—To Henry Higginson, of Wilson Street, St. Luke's, Middlesex, for a method of propelling boats by steam, &c. :—expired May 9, 1826.

**GUN CARRIAGES.**—To Col. Wm. Congreve, of Cecil Street, Strand, for an improved system of gun and carronade carriages :—expired May 11, 1826.

**NAVIGATOR'S SECTOR.**—To H. Ewington, of Bath, for an instrument, called the Navigator's Sector, by which any person is enabled to ascertain the difference of latitude, departure from the meridian, and distance sailed, &c. :—expired May 14, 1826.

**TUNNELS AND SUBTERRANEAN PASSAGES.**—To E. Shorter, of Barron's Buildings, Blackfriars, Surry, for various improvements in the construction of tunnels and subterranean passages : expired May 19, 1826.

**PAPER MACHINES.**—To Leger Didot, of Two Waters, Herts, for further improvements upon former patents, in machines for making both wove and laid paper :—expired May 26, 1826.

**IRON MANUFACTURE.**—To Jeremiah Dimmock, of Bilston, Staffordshire, for a method of manufacturing iron :—expired May 26, 1826.

**CRANES.**—To Wm. Hardcastle, of Derby, for an improvement on cranes, to prevent accidents from the rapid descent of heavy bodies : expired May 26, 1826.

### TO OUR READERS AND CORRESPONDENTS.

*Our next week's number will contain a full description of Mr. Howard's New Patent (Alcoholic) VAPOUR ENGINE.*

Anxious to oblige our excellent friend "Tipton Mechanic," we purpose sending to him in a few days by the post, a description of the machine he mentions; addressed T. M. Post Office, Dudley.

J. R. and S. S. next week.

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**MR. T. HOWARD'S PATENT VAPOUR ENGINE.**

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## MR. HOWARD'S NEW PATENT VAPOUR ENGINE.

WE are much gratified in being the medium of communicating an account of this very interesting invention to our readers, which is founded upon the well-known fact, that the vapours of alcohol or ether exert a much greater expansive force than steam, or the vapour of water, at similar temperatures. Chemical philosophers and engineers have long since agreed, that the former of those vapours might, in consequence, be very advantageously employed in motive engines, if means could be devised of preventing their escape; the expense of alcohol and ether being too great to allow of any considerable waste. The construction of an engine for this purpose, therefore, became a desideratum among scientific men; the difficulties and obstacles that have hitherto prevented its accomplishment, have, however, by the arrangements of the patentee, been overcome; and he has the distinguished merit of producing an alcoholic vapour engine, of extraordinary compactness and lightness; no boiler whatever is employed, the vapour being generated in the cylinder, and there is no possibility of its escape unless the execution of the work be very unsound. The new methods of producing the condensation of the vapour are also of considerable importance in their application to other purposes. As we have the specification of this invention before us, together with the remarks of the patentee, we shall annex a copy of it, omitting, occasionally, such parts as are not necessary to the description.

To all to whom these presents shall come, I, Thomas Howard, of New Broad Street, London, merchant, send greeting, &c. &c.—

I erect two metal cylinders (*a b*, drawing No. 1), made firm and secure by any of the ordinary methods. These cylinders communicate with each other at the lower part by a horizontal tube, or smaller cylinder, or otherwise so as to form a free passage at *c*, from one to the other. Then such a quantity of fixed oil, mercury, or other fluid, or substance becoming fluid, but not evaporating at the degree of heat to which it will be there exposed, is introduced into these cylinders, as will fill the base of the one, the intermediate passage, and nearly the whole of the other cylinder, to serve as a medium of heat necessary for generating the vapour for working the engine. Within one cylinder *b*, is placed a piston, exposed above to the pressure of the atmosphere, and having a rod and stuffing in the usual manner. In the other cylinder *a*, is placed a thin metallic dish *d*, floating freely upon the oil, or other fluid before mentioned. This latter cylinder has a top fastened down quite air tight, through the centre of which top is brought a tube *e*, proceeding from the condenser (hereinafter described), the lower end of which tube within the cylinder terminates in a nose pierced with many small holes. This tube is passed through a piece of cork, wood, or other imperfect conductor of heat, fixed into the top of the cylinder with a ring screwed down above it, in which the tube is made secure by a small screw *f*, in order that all these parts may be air tight. In the top of the cylinder *a*, is an oblong orifice, closed by a valve *g*, of the like form, which opens inwards by a rod *h*, striking the valve near one end with the advantage of a lever (as a door), at which end is a small hollow, for the purpose of receiving the rod; at the other end, the valve is confined to its seat by a crane-neck spring, bending over above it (as in the drawing No. 1, near *g*): the rod is entirely detached from the valve, so that

the rod has the power only to open the valve. The advantage of which is, that any accidental irregularity in the motion of the rod will not derange the valve itself. The valve-rod passes through an air-tight stuffing box, *i*, in the usual manner. A safety valve *k* is placed on the top of the cylinder *a*. There is an orifice, *l*, through the piston, into which is fitted a plug or stopper *m*, by means of which the height of the oil, or other fluid hereinbefore described, above the piston (which should always be kept a little above the piston), may be regulated when necessary. The oil, or other fluid, may at any time when required, be withdrawn from the cylinders by a cock, *n*, near the bottom, and may be again introduced by the top of the piston cylinder through the orifice *l*, in the piston. The degree of heat necessary for the purpose of working my Vapour Engine, is obtained by means of a sufficient number of lamps, *o, o, o, o*, on the principle of the Argand Lamp, and on a large scale when required. These lamps are supplied with oil, or other inflammable liquid, or gas, and placed below the cylinders, and the chimnies of which lamps are passed into and through a thin metallic or other covering, which covering is carried round both the cylinders (except the upper part of the piston cylinder), at a small distance from the cylinders, so as to confine and carry the heated air entirely round them. The lamp chimnies should be made of metal, with a hole therein, covered with talc, through which the flame may be seen, for the purpose of regulation. There is a tube or chimney, *p*, at the top of the last mentioned covering, which tube may be more or less closed by a top or register, *q*, the better to regulate the heat of the air within the covering. By means of a small forcing pump, *r*, which is set in motion, and the length of its stroke regulated by any of the ordinary methods in use in the steam engine, the tube *e* which enters the top of the vapour cylinder, is supplied from the condenser with the liquid, which is afterwards to be converted into vapour, within the cylinder *a*. The liquid to be employed may be either ether, alcohol, essential oil, or other liquid which evaporates more rapidly, and at a lower temperature than water. I do not however confine myself to any particular liquid or liquids, for even water may be used if the heat be sufficiently raised. The degree of heat to which it is proper to raise the oil, or other fluid medium within the cylinders, must be varied according to the nature of the liquid to be evaporated, and to the extent of power required. In order readily to ascertain, and be enabled to regulate correctly the degree of heat within the cylinder, a thermometer is attached to any convenient part, with its bulb passed through the cylinder into the oil or other fluid medium. From the nose of the tube *e* above described, a sufficient quantity of the liquid before mentioned is thrown by the action of the forcing pump *r*, not gradually, but quickly, and at once, upon the dish *D*, which being previously heated by the oil (or other fluid medium) on which it floats, quickly converts the liquid thrown on it into vapour, which vapour receives an increase of expansive power by the heat of the cylinder, and pressing upon the oil (or other fluid medium) and dish floating thereon, forces the oil through the horizontal passage *C*, into the piston cylinder, and raises the piston to its highest point of elevation. The valve *G* in the vapour cylinder being now opened, the vapour escapes by a tube *S* into a separate vessel (as in the steam engine of Watt) and is there condensed; the piston then returns by the pressure of the atmosphere, and the dish is carried again to the top of the vapour cylinder. The valve *G* is now closed, and a fresh portion of liquid is thrown by the forcing pump upon the dish, to be converted into vapour, and the operation is repeated as before. The dish *D* is not absolutely necessary, as the liquid may be thrown upon the oil (or other fluid medium); but I prefer a dish, which should be made of copper, with a flat bottom, the internal surface of which should not be polished. A sliding valve *T*, is placed across the horizontal tube or passage between the two cylinders, so as occasionally either entirely or partially to close the passage from one cylinder to the other, by means of which the motion of the engine may be easily regulated or stopped. In the top of the cylinder *A*, is fixed a tube *S*, by which the vapour is conveyed from the cylinder to be condensed,—and the tube should be divided, and a ring of cork, wood, or other imperfect conductor of heat *u*,

should be placed between the two parts, which should then be screwed up together air-tight. By means of this arrangement the transmission of the heat from the cylinder to the condenser is interrupted. The other end of the tube is inserted into, or communicates with, a circular tube or hollow ring, *V V*, into which a number of smaller tubes, marked severally *U*, made of copper or other metal, as thin as the required strength will permit, are fixed and arranged in a circle. These smaller tubes are also inserted into another vessel below *W*, which forms a reservoir for the vapour when condensed. The liquid formed by the condensed vapour may, by means of a pipe with a cock *d* placed in the bottom of the vessel, be withdrawn when required. The outer and upper part of the condenser has upon it a circular bason or open vessel *X*, into which water is thrown by a pump or otherwise, as may be convenient. The smaller tubes severally marked *U*, are each wrapped round, and covered on their external surface with flannel, or other porous substance of the like nature, which is carried over into the upper ring or bason *X*, from whence, being previously wetted, the water is absorbed, and the flannel or other other porous substance used, acting like a syphon, conducts it down the outside of these tubes into a vessel *Y* below them, from which it may be allowed to run off, or be pumped again into the upper vessel *X* if required. Within the hollow circle formed by these smaller tubes, severally marked *U*, is a machine upon the principle of a fan, kept in rapid motion by the engine or otherwise. By this means a continued stream of air is thrown upon the wet flannel, or other porous substance, and the heat is consequently thereby more quickly withdrawn from the condenser. Previously to setting the engine to work, it is necessary to withdraw the air from the condenser and vapour cylinder, which is done by means of an exhausting pump or syringe applied at *c*, to a pipe with a stop-cock *b*, fixed on the top of the condenser. The liquid to be converted into vapour for working the engine, is introduced into the vessel or reservoir at the bottom of the condenser, through a tube *e*, closed by a screw cap *f*. From this vessel or reservoir (the fluid in the cylinder having been first heated), the liquid is thrown into the cylinder *A* by the forcing pump *R*, as before described. A mercurial guage may be fixed in the usual manner to any part of the condenser, in order to shew the degree of exhaustion within. This method of producing condensation, consists in exposing the vapour or elastic fluid to be condensed, to a large surface of metal, surrounded or covered with flannel, or some other porous substance, continually absorbing water, and at the same time acted on by a stream of atmospheric air. And I claim the application of this new method of producing the condensation of the elastic fluids or vapour, as applicable generally, and not as applicable to my engine only. The condensation of the vapour or elastic fluid, may also be effected by injection upon the same principle as in the steam engine, but with the advantage of dispensing with the constant use of an air pump, and effectually preventing the escape of any of the vapour or liquid. To effect the condensation by injection a tube *S*, (drawing No. 2) conveys the vapour into an oblong vessel *g*, made of copper or other metal as thin as the pressure will allow. The required quantity of the liquid before mentioned, and to be afterwards thrown into the cylinder, is introduced into the condenser or vessel *g*, by the tube *e* as before, or by a funnel *o* on the top through a stop stock *p*. The forcing pump *R*, the tube *E*, to convey the liquid into the cylinder, the pipe and cock *b*, for withdrawing the air; and also the pipe and cock *d*, by which the liquid may at any time be withdrawn, are constructed as in the hereinbefore described condenser, and answer the like purposes. A lifting pump *k* is put in motion by the engine; at the same time the valve in the vapour cylinder (*G*, in the drawing No. 1), is opened as hereinbefore described, and the lifting pump withdrawing a quantity of the liquid before mentioned from the bottom of the vessel or condenser *g*, injects it into the top of the same vessel after passing it through a pipe or worm *i*, the end of which pipe *k* being pierced with many small holes, the liquid is dispersed throughout the vessel *g*, and condensing the vapour therein, passes with it to the bottom of the vessel. Part of this liquid is again thrown into the cylinder by the forcing pump *R*, to be converted into vapour

as before described, and part of it is again employed to condense the vapour in the manner last before mentioned. In effecting the condensation by injection, the condenser and tubes connected therewith are immersed in a cistern of cold water, a stream of which is continually passing through it, as in the steam engine. The vapour engine hereinbefore described, operates against the pressure of the atmosphere. This may be avoided, and a double action produced by the following alterations: (the Specification then proceeds to describe them.)

Although I prefer the use of lamps upon Argand's principle, in order to obtain the requisite degree of heat, to give motion to my vapour engine; yet an engine may be so constructed that fuel of any kind may be used. The foregoing are some of the combinations of machinery to which my invention is applicable, but I moreover claim, as my exclusive invention, the application for the purpose of giving motion to machinery, of vapour generated from liquids within the cylinder or other vessel, in which the power operates, the vapour receiving an increase of expansive power by the heat of the said vessel; particularly when the vapour is generated from such liquids as evaporate at a lower temperature than water.

IN WITNESS whereof I have hereunto set my hand and seal, this 15th day of March, in the year of our Lord 1836.—*Patent sealed 13th Oct. 1835.*

The annexed drawing describes an engine, which operates against the pressure of the atmosphere, and upon which also depends the return or vacuum stroke of the piston. Two methods of avoiding this and producing a double action, are given in the specification, but which are not inserted here. The following diagram presents an outline of a very effectual arrangement.

*a a* are the vapour cylinders or vessels (the form of which may be varied); *b* is the piston cylinder; *c* the piston, working horizontally. The arrangement of the lamps, injecting tubes, &c. is upon the same principle as before. The vapour is alternately generated within, and withdrawn from the two vessels, *a a*, and acts upon the piston through the medium of the oil or other fluid, upon which, or upon the thin copper floats, *d d*, the small quantity of liquid to be evaporated is injected as before described.

*Remarks by the Patentee.*—I have denominated my invention a "Vapour Engine," because the vapour of certain liquids, other than water, may be advantageously employed, the term steam being more properly applied to an engine which is worked exclusively with the vapour of water.

The leading principles upon which the invention is founded, are, the generating no more vapour than is actually demanded to produce the required effect; the farther expansion of the vapour in the vessel in which it operates; and the employment under these arrangements of such liquids (though not exclusively) as evaporate more rapidly, and at a lower temperature, than water. It is obvious that the first principle cannot be effected when there is employed a boiler, or generator, of any kind, distinct from the cylinder or other vessel in which the vapour operates by its pressure, and between which the communication is shut off at intervals. The advantage of preventing

the cooling of the cylinder of the steam engine was observed by Watt, and has been attempted in a variety of ways, and was successfully effected by placing it within the boiler, as in the high-pressure engine of Trevitheck. But I have no where heard of its having been proposed to raise the temperature of the cylinder *higher* than that of the boiler. This principle could not indeed be accomplished with its full advantage in the steam engine, because the expansion of the vapour by heating the cylinder would only be partial, for when the communication is open with the boiler, there cannot exist a greater pressure within the one vessel than the other; therefore the vapour in the boiler must also be expanded before the whole effect can be produced. When the vapour is generated, as in my engine, within the vessel in which it operates by its pressure, the same source of heat employed for the former purpose, is also made to increase the effect of the latter; the whole vessel being surrounded with a medium (either, air, or a fluid) heated by the fuel employed to generate the vapour. By these arrangements, combined also with a fluid medium within the vapour vessel, and which likewise prevents any escape of the vapour, the loss of heat by radiation, &c. is as much prevented as perhaps it possibly can be, owing to the small extent of surface to which it is necessary to apply the fuel, and to its being made to bear at once upon the vessel in which the effect operates. When we reflect that every additional  $40^{\circ}$  of heat doubles the previously existing expansive power of the vapour, the advantages of this system will be evident. While the temperature  $40^{\circ}$  proceeds arithmetically the expansion proceeds in a geometrical ratio, or nearly so. Other advantages are also obtained by generating the vapour in the vessel in which it operates. No injurious condensation of the vapour takes place by the injection of the liquid to be evaporated, because, at the moment of injection, there is no vapour in the vessel; neither is there any pressure to overcome in introducing the liquid.

When the idea first occurred to me of employing, instead of water, liquids which evaporate at a lower temperature, I perceived, immediately, that it would be hopeless to attempt the practice of such a theory upon the present principle of the steam engine; and when I afterwards found that such had actually been attempted with alcohol, I was not surprised that it had proved abortive. To say nothing of the danger of placing a furnace under a boiler containing a large quantity of an inflammable liquid, it would be almost impossible to prevent its escape, which would soon amount to far more than the saving of fuel that would be made upon *that plan*. After making many experiments it appeared to me that the vapour might, by a new and proper arrangement, be generated within the cylinder itself, and thus do away with the necessity of a separate boiler or generator of any kind. I ascertained that ether or alcohol would evaporate with sufficient rapidity, and would produce an instantaneous and very great pressure in a closed vessel, if the surface upon which a small quantity was thrown were heated to about  $100^{\circ}$  above the boiling point of the liquid. In these experiments mercury was employed as a medium

upon which to evaporate the liquid. The following table will explain the system.

Ether at the Temperature	Alcohol at the Temperature	Water at the Temperature	Force of Vapour in Atmospheres	Cubic Inches of Vapour of Atmos- pheric Pressure produced from 1 cub. inch of Liquid	
100°	175°	212°	1	1800	Pressure in Vacuo at the Temperature 60° in inches of Mercury. Ether 12 in. Alcohol 2 in. Water $\frac{1}{2}$ in.
140	215	252	2	3600	
180	255	292	4	7200	
220	295	332	8	14400	
260	335	372	16	28800	
300	375	412	32	57600	

and so on in proportion, for every additional 40° of heat, but gradually decreasing in effect as the temperature advances. The calculations are given only as an approximation sufficiently correct to illustrate the theory.

Suppose it be required to work an engine with ether, having a cylinder or vapour vessel or vessels, 20 inches in diameter and 30 inches in length, and with a pressure upon the piston, or (which is the same in effect) upon the intermediate fluid, of eight atmospheres, and which would be a very powerful engine. Such a vessel as that above described will contain about 10,000 cubic inches. This will require the evaporation of about 5 $\frac{1}{2}$  say 6 cubic inches of ether at 220°, and as 6 cubic inches contain nearly 1600 grains or drops of liquid, 5 drops must be evaporated from each square inch, since the diameter of the vessel, 20 inches, presents a surface of about 320 square inches. Five drops of ether upon a square inch of surface, heated to 220°, will evaporate with a rapidity sufficient to produce a motion equal at least to the condensing steam engine. By decreasing the heat or the quantity of liquid injected, the effect will be decreased in proportion, so that the motion and power of the engine may be governed with great exactness. If the quantity of liquid injected be decreased, and not the heat, the power (pressure) only will be decreased: the motion, so far as depends upon the quickness of evaporation, may even be increased. The relative proportion between the motion and power also depends upon that between the surface of the piston and the surface of the intermediate fluid, which receives the pressure of the vapour. It is not necessary at present to enter fully into this part of the subject; there must be, of course, a certain modification with regard to the temperature and the quantity of liquid injected, which will be found by practice to produce the most advantageous result, according to the purpose for which the engine is designed, and other circumstances.

Alcohol will furnish the same results as ether, if the temperature be raised 75° higher, and upon the whole this liquid may perhaps be preferable, particularly as it may be more readily and effectually condensed.

Water will also give the same expansive power at  $112^{\circ}$  higher than ether, or  $37^{\circ}$  higher than alcohol; but the motion of the engine would be comparatively slow at this degree of heat, and, therefore, independently of the necessary increase of temperature, the greater quantity of latent caloric absorbed by its vapour, and other circumstances, the same effect can only be produced from this liquid by a greater consumption of fuel. Nevertheless, there may be instances in which water would be employed, as, even in this case, the consumption of fuel will be very small, compared with the steam engine. It must be remembered that it is not necessary that the *whole* of the liquid injected should evaporate instantly. It is sufficient if it evaporate during the time occupied by the descent of the surface on which the pressure operates; and which pressure commences immediately upon the injection of the liquid, because a very small quantity of vapour is sufficient to fill the contracted space existing at this moment in the vessel, and which space enlarges with the increased quantity and pressure of the vapour, until the required motion be produced; when the vapour being withdrawn, the medium within the vessel returns by the pressure in the contrary direction, and again occupies the space from which it was ejected by the vapour. It is thus that no more vapour is generated than is actually employed; and, as this is the utmost degree of simplicity at which we can arrive, may we not presume, even from this cause alone, that it is the most effectual method of availing ourselves of the mechanical properties of the vapour of liquids?

The arrangement of the Argand lamps, and the manner in which the heat produced by them is made effectual, will be understood by inspecting the drawings annexed to the specification. The principle of the invention is, the permitting no air to approach the vapour vessels or cylinders, but such as has been intensely heated by passing through the flame of the lamps. Charcoal may be employed in much the same way; but when fuel of this kind is made use of, I propose to surround the cylinders with a fluid medium, instead of heated air, and which may also be added when lamps are used, but in this case it does not appear to be necessary. The surface exposed to the atmosphere may be coated externally with some imperfect conductor of heat. Many advantages will result from the employment of Argand lamps, particularly in navigation. In powerful engines they will of course be constructed on a large scale.

Having completed these arrangements, it became necessary to devise some other mode of condensing the vapour than that practised in the steam engine; for the injection of fresh portions of cold water, is, of course, inadmissible, when the vapour of other liquids is to be condensed. By the first method, given in the specification, the condensation is effected without injection. By surrounding the thin copper tubes with a porous substance, absorbing water from a vessel above, a continually renewed stream of it is brought into contact with them; and by subjecting this extended surface to the constant action of fresh portions of atmospheric air (which may be done in several ways) the evaporation, or, more properly, the solution in

air, of the water reduces the temperature very rapidly, and about  $10^{\circ}$  lower than can be effected with the water only, and a small supply of water is sufficient; for, I imagine, that, in most cases, the water will run off sufficiently cool to be again made use of. I propose the introduction, with some suitable modifications, of this method of condensation into distilleries. The first cost will be far less than that of the heavy worm and tub, at present in use; and, I doubt not, will be found more effectual.

A method of condensation by injection is also given in the specification, and I think it preferable to the former, where a large supply of cold water is readily obtained, as in navigation. The principle is the circulation through the condenser of the same liquid, which, after having performed its office within the condenser, is withdrawn, and previously to being again injected, is cooled by passing through a pipe, or worm, exposed, as is the whole of the condenser, to a stream of cold water. As no air is introduced, it obviates, in my engine, the necessity of an air pump in constant action. This method is, also, equally applicable to the steam engine, and would relieve it from a great part of the burthen of the air pump.

With respect to the safety of my invention, it will be seen that it may be made, at pleasure, either a high or low pressure engine. As it is perfectly easy to construct the vapour vessels of uniform strength throughout, and as the effect of the safety valve may be depended upon, because the vessels cannot be injured by the heat to which they are exposed, owing to the manner in which it is applied; it may be very safely proposed to extend the pressure to eight or ten atmospheres: not that this is by any means necessary to the success of the system, for a low pressure will answer to the theory equally well; and, as the size of the cylinders cannot generally be an object of much consequence, it may, perhaps, be considered preferable.

It was, originally, my intention to have delayed the publication of my invention until a model should be completed for the inspection of the public; but, as I consider the opinions and criticism of scientific men of far more consequence to its ultimate success, I have determined to submit myself to the latter ordeal; and I shall be happy to receive the assistance and proposals of those who may be willing and able to promote its success, with a view to its general introduction. That in accomplishing this purpose some of those difficulties may present themselves which are always attendant upon the introduction of a new system, I am fully prepared to expect; but that they can only be of minor importance I have fortunately been enabled to place beyond a doubt, by the experiments which I have made upon an engine (not yet completed) having cylinders of eight inches diameter. As it operates against the pressure of the atmosphere, this, alone, were there no other indication, is sufficient proof of the power of the vapour, and which seems capable of being carried to almost any extent. The motion commences *immediately* upon the injection of the liquid. It derives its heat from four gas lamps, of the ordinary size, which appear to be quite sufficient, notwithstanding the imperfection of the arrangements. I have generally made use of ether.

It stands in an area of three feet by two feet, which is the space that would be occupied by an engine of about ten horses power.

It is scarcely necessary for me to point out to those who are conversant with these subjects the advantages which will result from the employment of the vapour engine, particularly in navigation. It is proper, however, that I should take some notice of them. The most apparent are,—the very small consumption of fuel; the absence of all nuisance from smoke, and of a chimney flue, when lamps are made use of; the trifling space occupied by the quantity of oil, or other material, necessary, even for the *longest* voyage, compared with that at present required in steam vessels for the stowage of coal; the small space occupied by an engine of the greatest power; its perfect safety, portability, and moderate expense of construction.

12, Copthall Court, Throgmorton Street.

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### BENECKE AND SHEARS'S PATENT PROCESS IN PREPARING ZINC OR SPELTER.

In the ordinary method of preparing the sulphate of zinc, or spelter, the ore is exposed to the heat of a furnace in a melting pot, from the bottom of which a pipe descends into a vessel of water, for the purpose of receiving the metals as they are melted, and for condensing such portion as pass off in the form of vapour. An improvement upon this mode was the subject of a patent about fifteen years ago, in which it was so arranged that as the zinc volatilized, the vapour should be received and condensed in a separate vessel, leaving the melted metal, such as lead, and other impurities, in the former. Now the new process we have to describe is an improvement upon the latter mode; it consists, firstly, in a peculiar treatment of the ore previous to its introduction into the furnace; and secondly, in a peculiar arrangement of the retorts and other appendages, by which a more convenient mode of charging the retorts is obtained, and a purer metal is the result.

The ores are first to be roasted in the ordinary way, by stratifying them with fuel, and setting fire to the pile. The ore is next spread out in the air, and lixiviated to separate the sulphate of zinc; it is next to be dried, pulverised, and roasted a second time, until the sulphur is extricated; when it should be powdered again, and mixed with an equal quantity of carbonaceous matters, such as powdered coal, charcoal, cinders, &c.; in this state it is to be saturated with an alkaline ley, or a solution of common salt; the solutions varying according to the nature of the ore. Calamine, or other oxides of zinc, will require only to be pulverized and calcined.

With the ores prepared, as before mentioned, the retorts are to be charged; one of these is shewn in perspective at *a* in the annexed figure, they are made of fire clay, or such earth as will best stand the heat of the furnace. To the front end of these retorts are two apertures; the upper circular, for the reception of the neck of an earthen head piece *b*; the lower, *d*, are square, for clearing out the residuum

after working, which is closed during the distillation by a stopper, and luted. The head piece has likewise another tube fitted to it, and luted, merely for the purpose of lengthening it, sufficiently to allow the vapour to cool as it descends, and to condense upon an iron-plate beneath, as shewn in the lowest figure in the diagram, which represents a cross or vertical section of a reverberatory furnace, in which a double row of such retorts may be supposed to be arranged, with a long aperture between them where the fire is situated, which rests upon a grating over an arched passage, that communicates with the open air outside the building: this arched passage has a door, by the opening and shutting of which the heat of the furnace is regulated as may be required: and through one of the ends of this long furnace an aperture is made for supplying the furnace with fuel.



The earthen head pieces, *b*, it will be observed, have an aperture supplied with a stopper; through these openings the ore and carbon, prepared as before mentioned, are introduced in sufficient quantity by means of a ladle, into the body of the retort, when the apertures are closed and luted. The operation of distillation then commences; the zinc which rises in vapour passes into the head piece, *b*, down the pipe *c*, and falls upon the iron plates beneath in a condensed state.

By the arrangement described, the heads and necks of each retort is placed in a square recess or neck by itself, by walls built out between them, so that each may be perfectly closed in by a door from wall to wall. The doors are made of latticed wire work, for the purpose of holding clay when plastered over them, for the purpose of effectually confining the heat within the furnace; each of these doors has a central eye hole, provided also with a stopper for

watching the progress of the operation, and for enabling the workmen to determine the degree of heat to be applied and other circumstances.

By another arrangement the Patentees\* propose to erect furnaces with several tiers of cylindrical retorts placed one above another, with their necks or heads projecting beyond the front wall. The fire place is covered by a low arch to prevent the fire acting too violently upon the lowermost vessels; but through the arch apertures are made for the circulation of the heated air among the vessels above.

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### WILKS'S PATENT FOR REFINING OIL FROM SEED.

THE following is the process adopted by the Patentee (Mr. M. Wilks, of Dartford, Seed Crusher) for purifying the oil from linseed, as well as other seeds, by expression.

Into 236 gallons of the oil, six pounds of oil of vitriol is to be poured, and be well mixed by agitation or stirring about for three hours. Six pounds of fullers' earth is next to be mixed up and thoroughly incorporated with fourteen pounds of hot lime, and thrown into the vessel containing the oil and vitriol, when the whole is to be kept in agitation for about three hours more.

The foregoing mixture is next to be turned into a boiler containing a quantity of water equal to that of the oil, and the whole is then to be boiled for another three hours, during which time, the liquid is to be continually agitated by stirring. The fire may now be extinguished, and when the materials have become cool, the water may be drawn off, and the oil will be found clarified, which will become brighter and more fit for use after standing some time.

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### PECULIAR OIL FROM POTATOE SPIRIT.

M. M. BERTILLON and GUIETAND, manufacturers of rectified spirits, have obtained from the fermented fecula of potatoes, amongst the last products of distillation by the naked fire, a peculiar oil, which they believe to resemble that produced by the rectification of corn spirit. M. Pelletan has particularly examined this substance and purified it by repeated washings with water, and rectification from pulverized chloride of calcium. It is colourless, limpid, very fluid, has a penetrating odour, a hot, acrid, and penetrating taste, and does not soil paper. Its specific gravity is 0.821 at 57°. It is very fluid at Zero; but when the temperature is two or three degrees lower it assumes the appearance of congealed oil of aniseed; it boils at 257°. The impure oil boils much sooner, in consequence of the alcohol and water it contains; but as these bodies leave it, its boiling point approaches to 257°. This substance burns with flame, it takes fire by the approach of a burning body, but is soon extinguished; it does not burn continuously unless it be previously heated. Water

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\* Mr. Benecke, of Deptford, Verdigris manufacturer, and Messrs. Shears, of Fleet Market, Coppermiths.

dissolves a sufficient quantity of it to have its specific gravity diminished by 0.0102; it then assumes the smell of the oil, and froths by agitation. The oil also dissolves water, and when saturated has its specific gravity increased 0.0229. It is soluble in all proportions in alcohol, and water does not separate it, unless it be in great quantity compared to the alcohol; and when but little water is added, the oil is separated, and re-dissolves by agitation. The whole of M. Pelletan's results render it probable that the oil still contains a certain quantity of alcohol, after the repeated washings with water. If it should ultimately prove impossible further to concentrate it, we may regard this substance as an intermediate one between alcohol and the ordinary volatile oils; and yet merely as a modification of alcohol, and preserving the property of forming ethers with acids.—*The News of Literature and Fashion.*

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### EXTRACT OF MIMOSA BARK.

*From the Transactions of the Society of Arts.*

THE gold Ceres medal was this session presented to Messrs. Petchey and Wood, of Hobart Town, Van Dieman's Land, for making and importing five tons of extract of Mimosa Bark the growth of that colony :

*Certificate.*—I hereby certify to all whom it may concern that a certain liquid or extract, called the Mimosa extract, made from the bark of the Mimosa tree, the production of Van Dieman's Land, New South Wales, (fifteen hogsheds of which have been shipped by the manufacturers on board the ship Guilford, Captain Johnson, proceeding from this port to England), is solely and entirely prepared and manufactured by Messrs. Petchey and Wood, at their manufactory in Davey-street, Hobart Town, Van Dieman's Land; and that the casks containing the same are branded P and W and numbered 1 to 15—Given under my hand, at Government House, Hobart Town, this 11th day of June, 1824.

George Arthur, Lieutenant Governor.

The extract imported by these candidates is not almost dry, like that prepared by Mr. Kent. (see vol. 42. p. 176), but is of the consistence of tar or treacle; it is without the smallest degree of empyreumatic flavour, and is wholly soluble in cold water, which Mr. Kent's is not. It contains at least as large a proportion of tar as extract of oak bark of similar consistence, and will no doubt be very acceptable to our tanners. It is prepared by the same process as that described by Mr. Kent as far as boiling the bark in water to make the infusion. When this boiling has continued twelve hours, the liquor is strained off; it is then boiled twenty-four hours and again strained: and then boiled for twenty-four hours more, and strained again. It is then cooled and run into casks for exportation.

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## HOPPER'S PATENT SILK HATS,

The invention of the Patentee (Thomas Hopper, Esq. of Reading, in Berkshire) consists in an improved method of manufacturing silk hats. Having been favoured with a copy of the specification, we shall annex nearly an entire copy of it, as the several processes employed are therein described with more conciseness, clearness, and ability, than is usual in such documents.

The woollen substance, which forms the basis, is to be first boiled in a solution of the supersulphate of alumine and potash (common alum) for about two hours, in the proportion of two or three pounds of alum to a gallon of water. It should then be taken out, be well rinsed in clear water, wrung, and immediately dipped into a solution of glue, of variable strength, boiling hot, and put in a frame to dry, and give it a shape. The cloth thus prepared, before or when it becomes quite dry, may be again immersed in a strong solution of acetate, tartrate; or supersulphate of alumine, where it may be allowed to remain for a few hours, be then rinsed, and dried as before. The *acetate* is made, by dissolving separately in a gallon of water three pounds of alum, and one pound of sugar of lead, which are to be afterwards mixed, and decanted: the *tartrate*, by dissolving about two and a half pounds of alum, and one and a half pounds of cream of tartar, in a gallon of boiling water.

A third method is, to dip the cloth, previously alumed, in a solution of gelatin and one of the aluminous salts, added together: when wrung, immerse it once or twice in an alkaline lixivium, then dry it as it before. By these processes, the gelatin is fixed in what may be termed the first, second, and third degree, and the manufacturer may use the first singly, or combined with the second, as described, or the third only. In the last process, a double chemical change is effected; the acid of the aluminous salt quits it, and unites itself to the alkali; while its base, the alumine, combines with the gelatin, renders it insoluble in water, and remains together with it affixed to the cloth.

Various important advantages appear to be derived from the aluminizing process. It effectually removes the grease from the wool, by which, conjoined with its strong affinity for the cloth and gelatin (between which there exists but little naturally), it acts as a powerful intermedium in fixing the latter, enables it to resist the action of water, from the absorption of which, when used in its simple state, and consequent increase of volume, appears to rise one of the principle causes of the disjunction and falling to powder of the resinous gums. It likewise prevents the cloth from shrinking in any sensible degree, when subsequently wetted; facilitates the adhesion of the gums with the wool, and serves to equipoise those materials that are fusible by heat. The resinous gums may now be applied in the same manner as at present practised, or they may be used in the humid way, dissolved in a spirituous menstruum, with a proportion of Venice turpentine. It is usual to mix about a third or fourth part of resin or sandarac with the lac, but the mastick is preferable, on account of its superior tenacity; it contains a substance analogous

to caoutchouc. Caoutchouc, or elastic gum, may be employed, by dissolving it in rectified oil of turpentine, and rendered dry by pure alumine, or as much acetate of alumine as it will absorb upon being rubbed together. This is intended for the rim, which is, however, left to the discretion of the manufacturer.

Between the resinous gums and the varnish, an intervening substance, not fusible by heat, is necessary to prevent the latter from subsiding. Isinglass dissolved in weak spirits, gum acacia ("Arabic"), simple or pure\* aluminous paste, &c. suffice; the pure alumine is also used inside, mixed with common or resinous paste. The varnish, either that in common use, or the following may be employed, *vis.* asphaltum, 4 parts; gum, mastick or animi, 2 or 3 parts; drying linseed oil, from 2 to 3 parts: melt the bitumen and gum in an iron vessel over a charcoal fire, then add the oil; when well mixed, remove the oil from the fire, add Venice turpentine 2 parts, and gradually 6 or 8 parts of essential oil. Strain if it should be too thick; when cool, add more of the essential oil.

### Discoveries & Processes in the Useful Arts.

**IMPROVED METHOD OF BLASTING ROCKS.**—The method of blasting invented by Jessop is exclusively practised in the quarries of Soleure, and admits of some applications, as in the lifting of blocks out of their places after being blasted, of great service—it consists in simply covering the powder with sand. The greater the diameter of the hole, the coarser must be the sand. A variation in the nature of the charge has been introduced by M. Varnhagen, of Brasil: for example—the hole 3.5 inches in diameter, and thirteen feet deep; a mixture was made of five pounds of powder, and twice its volume of deal wood saw-dust, slightly moist, and sufficiently fine to pass a sieve having holes two lines in diameter. This mixture was pressed lightly into the hole, and filled it to a height of 7.5 feet; after placing a match, the remaining 5.5 feet were filled with sand. According to the report of the workmen, the explosion produced as complete and satisfactory an effect as would have been produced by twelve pounds of powder applied in the usual manner.—*Bib. Univ.*

**IMPROVED MICROSCOPES.**—Compound microscopes, both refracting and reflecting, can be placed completely on the same footing with telescopes, and reduced to the same accurate discipline in their construction. They are, in fact, nothing but telescopes, adapted to act with diverging rays instead of parallel ones. Dr. Goring suggests, in the Quarterly Journal of Science, that the term *engiscope* would perhaps be very applicable to them in their perfect form, which appears to be an improvement by Dr. Goring upon the reflecting ones constructed by Professor Amici, of Modena.—*Monthly Mag.*

**SUSPENSION BRIDGE OVER THE NEVA, AT ST. PETERSBURG.**—It is in contemplation to erect a suspension bridge of iron across the

\* Pure alumine may be obtained by pouring on a solution of alum, a solution of potash, soda, or ammonia, washing the precipitated powder with boiling water, and after filtering, drying the powder.

Neva, at St. Petersburg; it having been found impossible to erect a bridge of stone or wood, on account of the great depth and occasional rising of the waters. The depth above the ordinary level is about 42 feet, and this is increased by inundations to 60 or more feet. The proposed bridge is, therefore, to consist of *a single arch of 1022 feet span*. It is to be composed of three distinct bridges, one on each side, 9 feet wide, for carts, &c. a middle one with a road, 21 feet wide, for carriages; and two path ways, each 5 feet wide, for pedestrians. The suspension chains are to contain in their section, a total surface of 400 square inches.

**METHOD OF IMPRESSING STEEL PLATES**—The following directions for taking impressions from steel plates has been given by M. Hollander, in his *Metallurgico-Technological Journal*.

A mould of the object to be imprinted, into which is to be poured one pound of brass and five ounces of pewter, in a melted state. The steel plate is then to be rubbed with turpentine, covered with blotting paper, and the whole enveloped with earth, to prevent oxidation of the surface of the steel by the action of the air. The steel plate is then placed in a fire until it arrives at a red heat, when it should be immediately taken out, the earth cleared off, and the above-mentioned metallic composition is applied to its surface, and an imprint taken of it by means of strong mechanical pressure. Impressions in copper, brass, or any of the metals, may be thus taken from any subjects with facility and accuracy.

#### TO OUR READERS AND CORRESPONDENTS.

*We have to express our very great regret at being under the necessity of postponing our report of the interesting Lecture, delivered by Dr. Birkbeck, at the London Mechanics' Institution, on the Origin, Progress, and Perfection of the Art of Weaving. The process having been explained by many illustrative Diagrams, and lastly by the exhibition of Mr. De Bergue's Improved Power Loom, we have been anxious to render the subject complete justice, by having all the Illustrations engraved, the finishing of which in time, for this week's number, we find to be impracticable. Our next will, however, contain the whole of the Lecture, besides several Engravings of Mr. De Bergue's beautiful piece of mechanism, the effects of which have excited so much surprise and gratification.*

We cannot undertake to give insertion to R. W.'s Machine before we have seen a description of it; but we shall take pleasure in giving the subject every attention that it shall appear to deserve.

H. HAZ—D has made but a bungling attempt to disguise his hand-writing; such a letter, with an anonymous signature, cannot appear in the Register.

In reply to AN ENGINEER we have to state that Mr. Galloway's History of the Steam Engine, now publishing in a separate form, is a revision and an enlargement of that which has already appeared in the Register of Arts.

Mr. W——ms is informed that the Editor of this Work undertakes to assist Patentees with mechanical drawings and descriptions for their specifications.

We have not yet been able to procure the matter in question for TIPTON MECHANIC, but we shall take the earliest opportunity of fulfilling our promise.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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**DE BERGUE'S PATENT POWER LOOM.**

**London Mechanics' Institution,**

FRIDAY, 9th of JUNE, 1826.

**LECTURE ON WEAVING AND THE POWER LOOM,  
By DR. BIRKBECK.**

On FRIDAY the 9th of June, Dr. Birkbeck presented himself before the London Mechanics, for the purpose of delivering to them his promised Lecture on the Power Loom. *Mr. De Bergue*, the inventor of the Machine, accompanied the worthy Doctor. The great interest this subject has excited, and the prospect of its being treated on by the excellent President of the institution, induced one of the fullest assemblages we recollect to have witnessed. The power-loom stood on the floor of the Institution complete, and many diagrams and sections of other looms, were severally disposed of about the theatre. So soon as the applause occasioned by Dr. Birkbeck's appearance had subsided, he proceeded nearly as follows :

To a being so dependant as man, the Arts directly subservient to his support and protection, must present many objects of deep interest. Without those arts in particular, which supply him with food, which provide him with clothing, and which furnish him with shelter, in very few situations indeed, could man escape destruction. Some favoured spots there are, it is true, on the surface of this globe, where the soil spontaneously produces an abundant supply of food ; where the elements around him are so delightfully mingled, that in nakedness he can safely encounter and withstand, all their vicissitudes ; and where, destitute of habitation, night or day he seeks no other roof than his splendid canopy, the skies. Generally speaking, however, the unbought accommodations of this world are of a very different and inferior description. " By the sweat of his brow," in conformity with the early denunciation, man still continues to obtain those accessories to his terrestrial existence, just enumerated ; and it is only by the persevering exercise of that genius and power, with which the benevolence of his omnipotent Author has endowed him, that this primeval doom has been occasionally reversed.

It is not now my intention to attempt a complete and systematic investigation of these arts, the Arts of Life, as they have been emphatically designated, however appropriate such investigation might be, to the audience assembling in this place. I cannot even undertake to exhibit a regular detail of the processes belonging to the art, which the objects before you must show that I have chiefly in view. The most elementary stages, the formation and management of the different kinds of thread from which cloth is to be manufactured, I do not yet possess mechanical means for illustrating ; whilst of the final operation, weaving, I have had the good fortune to command, for your instruction, the use of one of the most perfect machines. I therefore avail myself of the opportunity, although with the disadvantage as to method, of beginning where I ought to terminate.

Whether the process of weaving was derived from contemplating the instinctive labours of the spider, as the poets have feigned ; or from observing the casual intertwining of vegetable fibres, especially of the macerated inner bark of several trees, as in the cloth prepared at this day by the inhabitants of the beautiful island, Otaheite, I shall not detain you to inquire. It is sufficiently clear that in the first instance it was a very simple manual art of crossing two sets of threads. To illustrate and render obvious the particular arrangement of the threads, we may take a piece of Russia matting, of which one set of threads is arranged longitudinally, while a second set is made to pass alternately under and over the first series, crossing these threads at right angles. Rude as this process is, the art of weaving, which probably originated in the eastern nations, might have proceeded from it, and have gradually advanced. The process of weaving is even now conducted there very similarly : the weaver spreading his warp on the ground, digging holes for his feet, and seated under a tree, to the branches of which he affixes his gear, working the latter in a very simple manner by means of a noose passed over his great toes. The whole machinery may be purchased for a few shillings ;

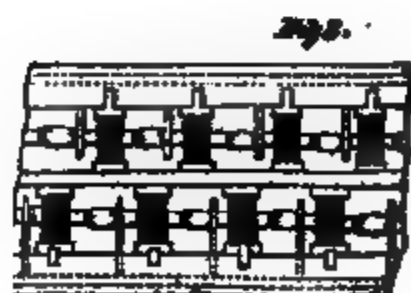
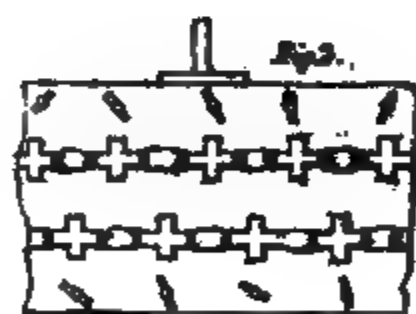
yet by this simple process the weaver produces fabrics of such exquisite fineness, that they have been called, poetically, "webs of woven wind." As an illustration of their exceeding delicacy, there is an eastern tale about a cow having licked up four or five of these webs, conceiving them to be only the dew on the grass. These fabrics are considered rather as objects of curiosity than utility, and are used exclusively by the native Potentates. In addition to the story I have before mentioned, there is an Oriental tale of one of these monarchs reproving his daughters for being too thinly clad,—an accusation which has sometimes been brought even against our own fair countrywomen—and her reply was that she was enveloped in fifty pieces of these fabrics. Such tales are, doubtless, exaggerations, but we may conclude from them, that the workmanship must have been exquisitely delicate though executed by this miserable machinery.

To explain the general process of weaving, the lecturer exhibited a large diagram representing a plan of a common loom, in which the important and necessary parts were shown in their relative situation; we here annex a copy of it.

From this it will be seen that the warp *a* is stretched horizontally in parallel lines the whole length of the loom; at one end (the back) it is wound round the roller *b*, called the *garn-beam*, and at the other end it is made fast to the roller *f*, on which the cloth is wound as it is woven. *c c* are the heddles or lames; (which cannot be properly shown in this figure) the use of these is to divide the threads of the warp into two equal parts; by the reciprocating action of treadles worked by the feet of the weaver, one heddle lifting up every alternate thread, while the other heddle depresses all the intermediate threads left by the former: an opening between the threads of the warp is thus uniformly made, through which the shuttle containing the shoot or weft is thrown, as from *d* to *d*; the batten *e* is then pulled forwards, which beats the shoot up closely, by means of a series of very thin metal plates (called the reed) formed by flattening fine iron wire, placed vertically between every thread in the warp. The weaver next pushes back the batten to its former situation, reverses the motion of his feet upon the treadles, by which the relative situation of the heddles are also reversed; the threads of the warp consequently cross each other, and open another channel between them similar to the former;

through this the shuttle is thrown back, and thus the threads are continually intersected or woven. *f* is a flat piece of hard wood, called a temple, with small points at the extremities for the purpose of keeping the cloth stretched out to its full breadth, as the process of weaving would otherwise tend to contract it: it is usually divided in the middle, and connected by a pin or pivot joint, where it is prevented from rising by a button, which keeps the stretcher straight, *g*, (represented black,) is the woven part of the cloth, which is wound round the roller *i*. *k k k* are three straight smooth sticks, inserted between the alternate threads of the warp, to prevent the same from becoming entangled. To preserve the warp in a state of tension, it is usual to pass a cord round the yarn beam *b*, with a weight suspended to the other extremity, and the cloth roller *i* has a serrated wheel, fixed to it at one end, into which a click drops that prevents its being drawn back; the warp is thus always kept straight and distended, while the weaving, or intersection of the shoot is effected, as already described.

Having thus explained the general principles of ordinary weaving, the learned Doctor next exhibited a complete model of a common loom, by the aid of which the several parts not shown by the preceding diagram were brought to view, and more explicitly described. By looms of that construction it had been usual in weaving broad fabrics to employ two workmen, one on each side to throw the shuttle backwards and forwards, and it was necessary to employ one workman to weave only a single piece of the narrowest cloth at a time. For the purpose of weaving tapes and other narrow articles, some improved machinery was subsequently introduced by the Dutch, which is now in common use, under various modifications, and known by the general term of Dutch Ribbon Looms; by these, one man was enabled to work from six to twenty-four shuttles at one time. Upon this foundation some improved arrangements were contrived by Mr. Goodman, for which a patent was obtained by that gentleman. The worthy lecturer here exhibited a diagram of Mr. Goodman's invention, (a description of which may be found in the first volume of the Register of Arts,) and explained its construction. We here annex the engravings referred to for the sake of illustration.



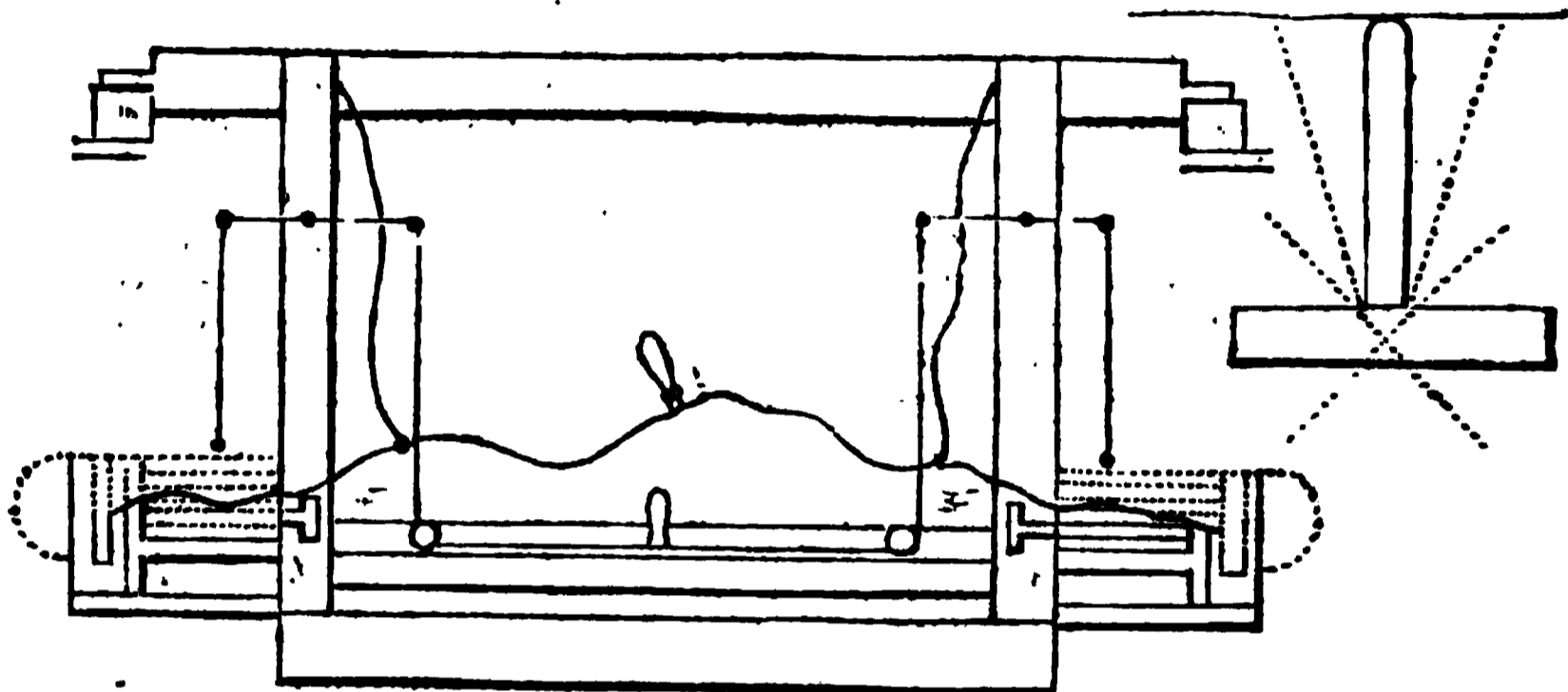
These improvements, as stated in the specification, consist in "a new arrangement of the shuttles and slays, as connected with the batten, and the knitting of the leashes." *Fig. 1* gives an end view of the loom, shewing the disposition of the warp for two sets of shuttles. *Fig. 2* shews a part of the front of the batten: and *Fig. 3*, the back of the same, by which is shewn the situation of the shuttles, the manner of fixing the slays, and the construction of the driver.

$\delta$   $\delta$  are the rollers upon which the material forming the warp is wound; from these the threads proceed as shown by the arrows over weighted rollers to the back slays: then under the warp rollers  $c$  to the leashes  $d$ , which are looped to arrange with each set of warps, and through which each distinct warp passes to its respective slay. The raising and depressing of the treadles  $e$  by the feet of the weaver, causes each of the leashes to move alternately up or down, and open the threads of the warp, the batten  $f$  is then pushed back, and the shuttles passed through the open space between the threads. The alternating motion of the treadles and leashes causes the intervening threads to be made fast, which are beaten up closely by bringing the batten  $f$  forward. The continued action of the loom in this manner, produces that intermixture of the waft and weft which constitutes the operation of weaving. The work as it is thus woven, is drawn off through small apertures in the breast-piece  $g$ , then round the work roller  $h$ , over the back castle  $i$ : from thence under weighted rollers or pulleys to keep the work distended, it is carried over the top castle  $k$ , and through holes in the work castle  $l$ , where it is made fast.



The Doctor next directed the attention of the audience to the diagrams which follow, as illustrative of the various dispositions of the warp and woof in the different manufactures. In the delineation of the diagrams he had received much valuable assistance from his young friend, Mr. Nichols, a member of the Institution. The first of these sketches, shewing a section of the warp, and the weft passing amongst the threads, represents plain work, such as calicoes, canvases, moneens, &c. the next is a double twill, such as shalloons; the third is the bombasin twill, twilled only on one side. The fourth is the arrangement called gambrom or lustrings; the next the arrangement introduced for forming kerseymeres; the sixth, the striped gambrom, of which too small a part is shown to render it distinct, and the last would have conveyed, if sufficient space had been afforded, the parts of a figure in damask, shewing as was done in the diagram in the theatre, the manner in which the exhibition or removal of warp or weft gave occasionally the ground, and occasionally the pattern.

There appears to have been no further improvement in the art of weaving till the year 1762. Mr. Kay, of Bury, then invented the *fly shuttle*, which enabled one workman to weave the broadest cloths, a second having been before necessary to return the shuttle. Mr. Kay's ingenious contrivance causes the shuttle to be driven backwards and forwards with great velocity by jerking the handle of a cord which communicates with two boxes at two extremities of the loom. When this invention was first introduced, notwithstanding that it enables the weaver to work in a much more advantageous position, it was opposed as a dangerous innovation. The action of the *fly-shuttle* will be understood by this figure, in which the handle, with the cords attached to the drivers, are shewn, and the course of the shuttle in the shuttle boxes, as the end of the lay also represents.



The next improvement was the result of that unfortunate effort which introduced the Power Loom. Vaucanson in 1747 was the first to suggest the employment of power; but the subject was neglected till 1784. The Rev. Edward Cartwright, brother of the celebrated Major Cartwright, then ventured to construct a Power Loom, though he had never seen a loom as commonly constructed. He happened to be at Matlock when there was some accidental conversation about the cotton manufacture. One of the company inquired "what would become of all the cotton which would be spun, when the patent of Sir Richard Arkwright expired?" Mr. Cartwright in consequence of this observation immediately thought it might be practicable to weave as well as spin by the application of water, or some other power. He commenced the construction of a Power Loom; but his first production was rather a clumsy piece of machinery. In 1790, it was brought into use at Doncaster, and underwent various improvements, suggested by Mr. Grimshaw, of Manchester, Mr. Bell, of Dumbarton, Mr. Miller, of Glasgow, Mr. Horrocks, of Stockport, &c. This machinery, notwithstanding, continued imperfect and clumsy till 1824.

The previous awkward manner of driving the shuttle, the frequent breaking of the threads, and the noise and racket resulting from the looms being worked, were inconveniences which can only be appreciated by those who have been in a room where thirty or forty looms were working at once.

We now come to the Power-Loom, of which M. De Bergue, on the platform before you, is the inventor. (M. De Bergue rose and acknowledged the greetings of the members.) This gentleman has honoured our country by saying, "If he had been aware that the English mechanics had attempted the same invention, he should have wanted courage to commence the task." There is also an ingenious Genoese weaver present, who will show you the operation of the machine.

Dr. Birkbeck then proceeded to describe this admirable invention. That our readers may, as fully as possible, understand this important part of the subject, we have furnished a series of engravings.

*Reference to Engraving of Mr. De Bergue's Loom.*—*Fig. 1* (frontispiece) represents a front elevation of the loom; *Fig. 2* a side elevation; *Fig. 3* the eccentrics *f*; *Fig. 4* the eccentrics or cams *k*: the letters of reference in the several figures designate the like parts.

*a* is the shaft, by the rotation of which all the various motions are simultaneously or successively produced. The rotation of this shaft is effected either by hand applied to the lay, which constitutes it a *hand-loom*; or, by means of a band or strap from another shaft *c*, passing over drum wheels or pulleys, as shown at *d* and *e*, which makes it a *power-loom*; the power or moving force required is, however, so slight, that the strength of a boy or girl is sufficient to work several looms by the turning of a winch.

*f f* are two eccentric wheels in the shaft *a*, in which two rollers *g g* also work. *A A* are two upright bars, screwed fast to the lay *b* above, and connected at their lower ends to the horizontal bar *i*, which turns upon pivots passing through the side frame *j j* of the machine. Now the rollers *g g* being fixed to the bars *A A*, in the manner shewn by the annexed *Fig. 3*, produce by their eccentric revolution in the wheel *f* that smooth, uniform, reciprocating motion, so essentially necessary to good weaving. This figure will require no particular explanation; *f* is the wheel, *k* the bar, *g* the roller, and *a* the shaft, as before mentioned.

*k k* (*Fig. 1*) are two other eccentrics or cams, by the revolution of which the heddles or lames *l l*, are alternately raised and depressed, thereby opening and crossing the threads of the warp as the shuttle is thrown between: to these cams two bars (answering to the treadles of the common loom) are attached by means of steel pins working in grooves; the opposite ends are connected at the back of the loom, by a common joint. As this part of the apparatus cannot be seen in the preceding elevations of the loom, we here annex a diagram by which the construction and operation of it may be understood,

*o o* are the bars or treadles, united by the joint *n* at the back of the loom; *l l* show the ends of the heddles, and the manner they are attached to *o o*; at *x x* are the steel pins, working in the peculiarly shaped groove described as the wheel revolves upon the central axis *a*. *m* is the middle wheel, with a deep groove on each side of its periphery, having a channel leading mutually from one to the other, so as to cross each other like the letter X, in the manner shown. In these grooves or channels a projecting pin from the shuttle rod *s* works; so that by the revolution of the cross grooved wheel *m*, the rod *s* is thereby thrown from one side to the other, alternately. To the upper extremity of this rod two cords *e e* are attached, the other ends of which are tied to the drivers *p p*, that slide freely upon a polished wire, fixed in a channel of the lay, wherein the shuttle works to and fro; it will now be perceived that the reciprocating motion of the rod *s*, by means of the cords *e e*, gives a jerk alternately to each of the drivers *p p*, by which the shuttle is thrown backwards and forwards through the divided threads of the warp.

The reed or cane which is the immediate instrument for beating up the threads as they are successively shot through the separated threads of the warp is situated in the lay or batton as shown at *q q*, *Fig. 1*. the fly wheel is marked *r*. The cloth, as it is woven, passes over the breast beam *s*, and winds itself on a roller *t*, which receives its motion by a toothed wheel fixed upon it, and a pinion upon the same axis as the ratchet wheel *u*. The apparatus for putting the drum or strap wheel into gear, so as to use the machine as a power loom, is shown connected with it on the right of *Fig. 1*.

M. De Bergue's *loom* may be used either as a hand loom or a power loom, and is entirely composed of cast iron, with the exception of the axis, which, carrying all the moving eccentrics or cams, requires great strength, and is of wrought iron. When it is used as a hand-loom the horizontal bar is moved backwards and forwards. This is not, as you will imagine, a very difficult operation, and were I not afraid of causing a loss of time by breaking some of the threads, I would show you that I could make a tolerable weaver; for with this machine I could manufacture a piece of *Gros-de-Naples*, as well as any Spitalfields' operative, (*a laugh*). When the machine is used as a power-loom, motion may be communicated to it by a wheel, which is turned by the hand, by steam, or by water. A single wheel will give motion to several looms, and a steam engine will work, of course, a much larger number.

[The machine was then worked by the Genevise weaver. Dr. Birkbeck requested the members to look at their watches, and mark the time elapsing before the sheet was expended.]

"You perceive, that in the course of two minutes, one inch and six tenths of the web have been manufactured. The calculation, at an inch and a half, forty-five inches would be manufactured in an hour, and in twelve hours there would be produced as many feet. Threads, however, occasionally break, and some allowance must be made for the time lost in rejoining them. There are now 1100 divisions in the breadth of the *lay*, or *dents*, as they are called, and each contains three threads, as each of these threads is double, we find there are 6600 natural fibres of the Silk-worm in the *warp*."

[M. De Bergue next exhibited the machine as a power-loom, which he did by giving motion to a fly-wheel. While the machine was in motion, one of the threads broke, and the motion immediately ceased; and the manner in which this was effected was described.]

This, continued the worthy Dr. is another proof of the ingenuity exercised in the contrivance of the loom; for if the motion had continued, the reed would have been spoiled. I will now read a paper which has been put into my hands by one of the proprietors, describing the advantages of Mr. De-Bergue's invention.

"In common looms worked by hand, and which are chiefly employed at the weaver's own home, the workman's feet are employed in working the treadles, the hands in throwing the shuttle, and the breast in rolling up the silk. And the best and most experienced workmen are liable to irregularities in their pieces, from the uncertain stroke of the *lay* and *shuttle*; which can never happen in this loom, as the stroke both of the *lay* and *shuttle* are uniform and invariable.

"In this loom, one movement does the whole, and one hand is sufficient to work it. Therefore, in the former case, when a workman, when sick, would be obliged to be idle, and his family lose the advantage of his wages, in the present loom his wife or son could work the loom, (in an easy and healthful position) whilst the sick man, if not confined to his bed, could superintend the web or chain without much exertion.

"The objection made by the weaver to power looms, arises in a great measure from their necessary employment in large manufactories, where steam engines must be the first moving power. With this loom a weaver with his family, may become a power-loom weaver; for, by a wheel in a corner of his room, and one of his children or a common labourer to turn it, he can superintend two or more looms, and thereby double his daily earnings: and so in proportion to the number of his family, and the capacity of his weaving apartment.

"The receding motion of the *lay* being slower than the advancing motion, (an advantage which is absolutely necessary for weaving silk) gives a greater time to the shuttle to pass slower, and consequently enables the weaver to put a more tender shoot in his shuttle, or to weave a broader cloth.

"The shuttle will pass from 60 to 150 times per minute, according to the will of the weaver, and always with the same uniformity.

"The simplicity and the ease with which the weaver can regulate its different motions, by loosening or tightening the pressing screws on the only axis there used, by which the motion must always be uniform and regular, one part with another, are additional recommendations; to which may be added, its probable durability without repair: as those parts which are most likely to be deranged, will not require two shillings to repair them.

"The patentees, in order to give this loom an early extension, and with a view of putting it within the reach of the poorest mechanic, have demanded a very moderate patent right; not half the amount generally claimed by patentees of other looms."\*

But after all that has been now advanced in commendation of this machine, before we are allowed to congratulate ourselves upon its acquisition, we shall probably have to encounter a strict scrutiny, in the substance of the following questions. Whether it is not an invention which may save too much labour, and which therefore, as Montesquieu was one of the first to maintain, is hurtful to the community in which it is employed? Whether it is not, like every discovery in arts and sciences, which renders, or may be suspected to render, production fully equal if not superior to consumption, as Sismondi contends, a calamity, adding only to the enjoyments of the consumers the opportunity of obtaining them at a cheaper rate, while it deprives the producers of even life itself? Whether, in short, to point the inquiry directly to ourselves and to the appalling circumstances of the present moment, the power-loom, although generally in its construction and therefore in its produce, greatly inferior to the machine before us, has not already brought severe distress, and even famine, upon a large portion of the manufacturing population of this empire?

If it were suitable or possible, now to enter at length into the scrutiny suggested, I might without much difficulty show you, that the manufacturing, like the mercantile system, has had in every age and country, a strong propensity to disregard or overlook, the advantages accruing to each, through every advantage accruing to the consumer. "In the mercantile system," says Adam Smith, in the third volume of his celebrated Inquiry into the Nature, and Causes of the Wealth of Nations, "the interest of the consumer is almost constantly sacrificed to that of the producer;" but he also observes, "consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to, only so far as it may be necessary for promoting that of the consumer." That the same feeling governs the manufacturing system, of which the labouring classes constitute the largest portion, is proved by their invariable hostility to the introduction of any machine, which seems to supersede or even to diminish, the demand for and subsequent value of, their physical power. The crane at Strasburgh, the Dutch ribbon loom, the saw mill, the stocking frame, the spinning jenny, the cropping machine, the thrashing engine, and the power loom the last object of their misdirected efforts of self-preservation, have all in their turn, been broken, burnt, or otherwise destructively dealt with. This absurd conduct, to apply to it the mildest possible epithet, has arisen from an apprehension, as already hinted, that whilst benefiting the capitalist and the consumer, the labourer or the producer, was or could be injured. Experience, were it coolly and dispassionately consulted, would be found most distinctly and universally to

\* Proposed establishment of a Silk Weaver, commencing with De Bergue's Patent Loom, showing his probable Expenses and Profit, provided he can have two years to pay for his Machinery.

#### GENERAL EXPENSES.

First Cost and Patent right of Three Silk Looms, .....	£46	10	0
Wheels and Fittings, .....	6	0	0

† 52 10 0

ANNUAL EXPENSES.	£.	s.	d.
Hire of an additional room to work in	3	0	0
Hire of a lad to turn the wheel (in case the workman has no son or daughter capable) for 313 working days, at 9d. per diem .....	12	3	1
Expence of feeding his family for 365 days, at 3s. per diem. ....	41	15	0
Clothing, schooling, and firing .....	12	0	0
Rent for his dwelling rooms .....	10	0	0
Wear and tear of his machinery, ....	3	0	0
* One half of the first cost as above ..	26	0	0
<b>First Year's Expenses ....</b>	<b>107</b>	<b>8</b>	<b>1</b>

ANNUAL RECEIPTS.	£.	s.	d.
These looms can make 16 yards of silk per diem each; but, allowing for stoppages, &c. we will suppose they make but 10 yards each, this, at 4s. per yard, will give 3s. 4d. per diem for the 3 looms, thereby giving to the weaver for his 313 working days 156 10 0	156	10	0
<b>First Year's Receipts ....</b>	<b>197</b>	<b>8</b>	<b>1</b>
	48	1	11
If his own Family work the wheel, the time of the lad must be added, and his profits .....	15	3	1

Clear annual profit ..... 60 5 0

† These looms may be procured in London, of Messrs. Taylor & Martineau, City Road; or at Manchester, of Messrs. Sharp, Roberts, & Co.

negative this impression : the very benefit which they allow to have accrued to the capitalist, is a benefit always inseparable from themselves : and the following propositions which embody this opinion, I strongly recommend to the serious contemplation of every individual interested—and who, I may ask, is not interested—in this great discussion ? These propositions are extracted from a work entitled “ The Economy of Social Life,” written by Mr. John Marshall, of Leeds, one of the most opulent and enlightened manufacturers in this kingdom : giving you for six-pence, admirably concentrated, the essence of all the large and elaborate works on economical science.

“ Whatever tends to improve or facilitate labour, increases the productions of the country. Therefore, whatever abridges and facilitates labour, will eventually increase the demand for labourers.”

“ Whoever may be the proprietors of the wealth produced, they can derive no advantage from it but by employing it ; that is to say, by maintaining with it productive labourers. The more abundant, therefore, this wealth is, the more people will be employed.

“ The permanent demand for labour depends on the increase of capital, compared with that of population, and on the power of employing additional capital to advantage.” Lastly,

“ In manufactures and commerce, the use of machinery adds the efficiency of the powers of nature to the labour of man, and increases the fund applicable to the support of human labour.”

This influence of capital converted into machinery, the only mode I am disposed to maintain, in which capital can be extensively productive, being admitted, it may still be urged, that in the first introduction of any species of machinery, some individuals, who effected by manual labour that which is by it more abundantly produced, must be injured, or at least incommoded : and likewise, that by machinery, the mischief resulting from what has been termed a partial or general glut of the market, will probably, if not certainly, result. To the first objection, I shall content myself with opposing the pertinent remarks of Sir James Stewart, whose Enquiry into the Principles of Political Economy is one of the earliest productions in this important branch of science. “ It is hardly possible,” he observes, “ suddenly to introduce the smallest innovation into the political economy of a state, let it be ever so reasonable, nay, let it be ever so profitable, without incurring some inconvenience. A room cannot be swept without raising dust ; one cannot walk abroad without dirtying one’s shoes ; neither can a machine, which abridges the labour of men, be introduced, *all at once*, into an extensive manufacture, without throwing many people into idleness. These inconveniences, however, are only temporary ; the advantage is permanent ; and the necessity of introducing every method of abridging labour and expense, in order to supply the wants of luxurious mankind, is absolutely indispensable, according to modern policy, according to experience, and according to reason.” To the second objection I shall direct the powerful opinion of my friend Mr. Mill, the distinguished historian of India, who, in his Commerce Defended, thus triumphantly puts to flight the chimera of a general glut of commodities. “ The production of commodities is the one and universal cause which creates a market for the commodities produced. Let us but consider what is meant by a market : is any thing else understood by it, than that something is ready to be exchanged for the commodity which we would dispose of ? When goods are carried to market, what is wanted is, somebody to buy. But to buy, we must have wherewithal to pay. It is obviously, therefore, the collective means of payment, which exists in the whole nation, that constitute the entire market of the nation. But wherein consist the collective means of payment of the whole nation ? Do they not consist in its annual produce, in the annual revenue of the general mass of its inhabitants ? But if a nation’s power of purchasing is exactly measured by its annual produce, as it undoubtedly is, the more you increase the annual produce, the more, by that very act, you extend the national market, the power of purchasing, and the actual purchases of the nation. Whatever be the additional quantity of goods, therefore, which is at any time created in any country, an additional power of purchasing, exactly equivalent, is at the same time created ; so that a nation can never be naturally overstocked, either with

capital or with commodities, as the very operation of capital makes a vent for its produce."

If in thus contending for the most extensive application of machinery, I did not clearly perceive as regards the capitalist and the labourer, a benefit perfectly reciprocal; if I did not fully believe, that the value of labour, or the natural and necessary wages of the workman, would not be as high, where machinery is prevalent as where it is excluded, or even generally somewhat higher, such is my opinion of the efficacy of high wages, in bettering the physical, social, political and intellectual condition of the labourer, that I would at once renounce all the notions which I have ever entertained, in favour of the productions of mechanical invention.

I differ entirely from Dr. Franklin and other philosophers, of whose benevolence and zeal in the cause of humanity no one can doubt, when they maintain, that high wages, instead of encouraging industry, become a fruitful source of idleness and dissipation; and as thoroughly agree with Mr. M'Culloch, the ingenious and intelligent political economist, when, in his Essay on the rate of wages, he asserts, that "no country can be flourishing where the rate of real wages is low, and that none can be long depressed where the rate is high:" and I am exceedingly anxious, that it should never be forgotten by the individuals who purchase the labour of their fellow-creatures, that *they who feed and clothe, and shelter, all the rest, ought themselves to be well fed, and clothed, and sheltered.* In this Essay the subject of wages is considered in a manner so concise and instructive, that I warmly recommend it to your attentive perusal: and I am happy to add, that twenty copies of it will be placed in the library for your service, by my patriotic friend Mr. Gibson, the president of the Spitalfields' Mechanics' Institution.

In the circumstances which relate to these instances of the distribution of wealth, we must, if they are assiduously examined, recognize those characters, which display the beauty and the harmony of the ordinances of the universe. In no branch of the dispensations of Providence, except when viewed with the most contracted eye, can there be detected a partial purpose. No sacrifice of the happiness and well-being of the multitude, to the accommodation and enjoyment of a few, can there be described. The records of creation, which largely attest the exercise of infinite wisdom, not less diffusively, attest the exercise of infinite benevolence. No system could be devised, calculated more extensively and effectually, to promote the happiness of a world peopled like our own, than that, in which "self-love and social are the same:" no arrangement could have secured to sensitive and intelligent existences, a larger share of happiness, than that reciprocity of benefit, which has been permitted to flow from the operation of genius, where it has been left unobstructed and free: for genius in diffusing its benignant and ennobling stores, as has been beautifully pronounced of the quality of mercy, by our immortal poet,

"is twice blessed;  
It blesseth him that giveth, and him  
That receiveth."

~~CONTENTS~~

## History of the Steam Engine.

### CHAPTER III. continued.

CONTENTS.—WATT'S ROTATIVE ENGINE,—BRAMAN'S REMARKS.

We now close our descriptions of Mr. Watt's inventions, by giving a short account of a Rotatory Engine, included in his patent of 1784.

Fig. 1 is a ground plan, and fig. 2 a section. *a a* is an external cylinder, or reservoir, filled with heated water, quicksilver, or an amalgam (which would become fluid at the boiling point). *b b* is an interior cylinder in the middle of *a a*, and turning upon a pivot *o*. A partition *c*, reaches from top to bottom, dividing the vessel into two

equal parts. *d e* are two valves, allowing the liquid to ascend and fill the interior of *b b*, but preventing its egress in that direction. *f g* are two tubes, or apertures, for guiding the escape of the liquid in the direction of the arrow. *j* is the pipe for the admission, and *k* for the exit, of the steam. The steam being introduced from the boiler through *j* enters the cavity *l*, and passes on the surface of the water, driving open the valve *i*, (*fig. 1*) and issuing through *g*, in the direction of the arrow, thus pressing upon the body of the liquid in the reservoir, and producing a re-action; which drives the internal vessel round. When it has performed nearly half a revolution the cavity *n* comes under the steam passage. This will be understood better by *fig. 3*: *p p* is a hoop encircling the upper part, or neck, of the vessel *b b*; *l* is a hole in the side of the vessel communicating with one side of the vessel, and *n* a similar hole communicating with the other. It will be seen that, at present, the hole *l* communicates with *j*, and the hole *n* with *k*, but, by turning the vessel half way round, their situations will be reversed; *l* communicating with *k*, and *j* with *n*, so that each side is successively exposed to the action of the steam, and to the condenser. By this means, therefore, the hole *n* is next in communication with the steam pipe *j*, and the valve *d* being shut by the steam pressing on the surface of the liquid; the valve *i* is opened by the same means, so that the liquid is forced with violence through *f*, in the same manner as it was previously forced through *g*. Whilst this operation is going on, a vacuum is formed in the first vessel (by *l* communicating with the condenser) so that it becomes charged and ready in its turn to receive the action of the steam. When it does, the first operation is repeated, and a rotatory motion is kept up by the alternate action of the liquid driving through

the cavities  $f g$  in nearly the same manner as the motion is produced in the well-known machine commonly called Barker's Mill, differing only thus;—that the water from the latter acts against the air, whilst this acts upon the fluid in which this is immersed. The motion is carried through the top of the reservoir  $a$  to a stuffing-box  $q$  (not shewn), and attached to the machinery.

It appears this machine was tried, and found to have little or no power; which, of course, was the reason of its abandonment. The cause of its trifling effect arises from the force of the escaping liquid acting upon a medium, which affords no solid resistance, and is, therefore, incapable of producing any powerful re-action in the machine.

We close our detail of the inventions of this truly great man, by remarking, that there have been few men who have contributed so much to the promotion of commerce and manufacture; yet, whilst we admit him to have been capable of producing the most wonderful effect of the mind, there are some of the inventions which have come under our notice that many of the obscurest mechanics would blush to own. He has been compared to a walking encyclopædia, and the comparison is truly apropos, when we consider that an encyclopædia is the reservoir of the most worthless, as well as the most useful, knowledge. Judging by the effects which his inventions have had upon society, we cannot hesitate a moment as to determining that he is deserving of great praise; but judging by those inventions which he put on record in his many patents, we feel astonished that the same mind should be capable of producing ideas of the most useful and the most worthless kind. Incapable of discriminating, he seems to have no sooner formed an idea than he has made it the subject of a patent, so that we found almost three out of four of the schemes which are included in his specifications have never been carried into execution.

We have already expressed our opinion respecting Mr. Watt's eager desire to secure to himself the benefits of any idea that entered his mind, even in the most unsubstantial form. In this opinion we are not solitary, in proof of which, we make the following extracts from a letter addressed to Sir J. Eyre, then Lord Chief Justice of the Common Pleas, by Mr. J. Bramah, dated 1797.

Speaking of Mr. Watt's first specification, on which we have already remarked, he says, "In considering the part arranged *first* in this specification, I cannot observe the words there used create in the mind of the reader any new idea respecting the construction, proportion, or office, of that part of an engine properly called the steam cylinder. The enquirer is left wholly uninformed, whether the intended cylinder, or steam vessel, is to be left open at top, and shut at bottom, or shut at top, and open at bottom, or whether both its ends are to be alike shut; nor is he directed in what manner the steam is to be admitted into the cylinder, or in what manner discharged: there being no mention how, and in what part of the cylinder, the necessary inlets and outlets are to be contrived, notwithstanding the essence of every engine depends thereon. There is likewise no mention made of the form and action of the piston, or the method of connecting it with the external and working parts of the machine, or whether the expansive force of the steam is exerted on the upper or under side of the said piston; or even whether there is a piston employed at all."

"This part of the specification appears calculated to mislead and perplex; and I am fully persuaded, were these imperfect directions given to any workman, even of the most eminent knowledge in the art of building engines, they would tend directly to frustrate every regular step necessary to be taken in the progress of such a work."

"Had there been a shadow of a guide introduced into this mysterious composition, an ingenious mind might have accidentally stumbled on the inventor's mark; but it is so much the contrary, that every adventurer is constrained to explore a way for himself, and to wrap his cylinder in any warm covering his powers of judgment may suggest: and it is my firm opinion, that were engine builders in general left to puzzle out this single circumstance, ninety-nine out of every hundred would attempt a different method of accomplishing the inventor's intention; and I am likewise as fully convinced, that a like proportion would finally miss their aim, in spite of repeated efforts."

"The first thing which attracted my attention when inspecting an engine built by Mr. Watt, was the steam cylinder, which I observed shut at both ends, contrary to that of Newcomen, which is always open at the upper end, whereby the atmosphere acts upon the upper surface of the piston, both in its ascent and descent."

"A slight pause on this circumstance soon presented to my view a total contradiction to the article in Mr. Watt's specification, denominated *fourthly*, where he asserts that 'he intends in many cases to employ the expansive force of steam to press on the pistons, or whatever may be used instead of them, in the same manner as the pressure of the atmosphere is now employed in common fire engines.'"

“ On reading this paragraph, every person acquainted with Newcomen will naturally ask,—How can the expansive force of steam be applied to press down the piston in the manner it is now performed by the atmosphere, which requires the top of the cylinder to be kept open? For, suppose steam to be poured on to the top of it instead of air, where is there any footing or abutment for the re-action of this expansive element? I clearly perceive, says the enquirer, that the air performs this office by its gravitating power, which requires no butment. But how can any expansive force be employed without it; since it is a law of nature that no force of this kind can be exerted without being first prevented from expanding on the contrary; or at any rate, without having a resistance in all directions, equal at least to the force of action required?

“ These reflections, I conceive, would induce a conclusion, that the man who proposed such a thing must be either a fool or a mad-man. But to return—

“ On considering the strange difference I saw in this machine from that of Newcomen, I concluded in my own mind the following to be the real invention of Mr. Watt in the cylinder part of the engine. First,—He has completely inverted the order of Newcomen, by turning the cylinder upside down. Secondly,—By making the proper inlets and outlets for the steam, at the upper instead of the lower end of the cylinder. Thirdly,—The valves used in these inlets and outlets, for the purpose of admitting and shutting off the steam; and for retaining it in the cylinder and discharging it; the manner of giving motion to them from without, are very peculiarly and curiously contrived, and totally different from any article ever applied in Newcomen's Engines for the same purposes; and these valves, &c. I observe, are made always of brass, or a mixture of copper and brass; and I cannot see of what other metal such very essential parts could be made; as iron would soon rust, and in a few weeks lose the perfection requisite to keep them air and steam tight. Fourthly,—I cast my eye on a single part of the engine; and which part not being properly accomplished, would render finally abortive all the efforts it is possible to make in giving motion and power to the machine.”

#### TO OUR READERS.

*NOTICE.*—The Editor's present engagements in assisting Patentees with their Drawings and Specifications will prevent him from bringing out the Numbers of this Work, oftener than once a fortnight, some time hence; during which period the Lectures of the London Mechanics' Institution will necessarily be omitted, to allow sufficient room for the description of all the new patented inventions of importance, of which the Editor has hitherto had the good fortune to be enabled to give the earliest, and the most correct, account.

Correspondents will be replied to in our next.

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# REGISTER

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CHOICE AND GIBSON'S PATENT BRICK MAKING MACHINE.

## CHOICE & GIBSON'S PATENT BRICK-MAKING MACHINE.

THE frontispiece to our present number gives a faithful representation of a new Brick-Making Machine, which we saw in operation a few days since, when we made a sketch, of which the preceding engraving is a tolerably correct copy. The eye of the spectator is supposed to be placed in a horizontal line with the centre of the picture, by which all the essential parts are exhibited at one view, thereby rendering it unnecessary to resort to the usual mode of giving a variety of plans and sections; while it is at once more easily understood by the general reader.

The patentees are Messrs. Choice and Gibson, of Islington, (the former of No. 2, Strahan Terrace, and the latter of No. 13, White Conduit Terrace.) The construction of the machine appears to us to possess a great deal of originality; many of the arrangements are extremely ingenious, and the whole seems well calculated to answer the intended purpose; especially when the workmanship is rendered in a second machine of a more solid and durable kind, for the one which we saw was the *first* constructed, wherein, as is mostly the case, some of the subordinate parts had been so repeatedly altered, had been as it is called, "*cut to pieces*;" so that full dependance could not be placed upon their uniform perfect action. Notwithstanding these disadvantages, however, the bricks turned out by this machine were of a very solid quality, and the accuracy of their figure well preserved. The number of bricks, which such a machine can manufacture in a day with the labour of two horses is about twenty thousand, which it should be remembered includes the grinding or mixing of the clay in the pug-mill, wherein one horse is always employed in the ordinary process.

*Explanation of Engraving.* *a a a a* is an upright frame work, with cross beams at top and bottom; *b c*, are two vertical shafts, carrying two horizontal spur wheels *d* and *e*, the teeth of which take into one another; these are put in motion by the horse shaft *f* (or any other convenient power.) Near the bottom of shaft *b* is fixed a large cast-iron collar *g*, having three deep mortices, into each of these the end of a flat iron arm *h* is fitted, with a bolt passing through them to form a centre, as the pin in a hinge joint.\* To the other extremity of each of the arms *h*, is firmly fixed by screw bolts, a cast iron mould box *i*, having three divisions for three bricks, in which work three stocks or false bottoms, having upright bolts passing through holes at the top. By the revolution of the shaft these mould boxes with their arms are successively carried up and over the risers *k k k*, (which form circular curves in the plan, and appear so in the perspective, but are really inclined planes, which they would present in a horizontal view.) At *l*, near the bottom of the shaft is a small bevelled wheel which actuates a pinion, fixed on the spindle of the drum wheel *m*, that passes under the floor of the machine; an endless strap passing round the drum *m*, and another placed at the required distance continually carries the bricks forward to their destination.

as fast as they are made, and deposited upon it; *o* is a crank or lever attached by a joint to the framing as shewn, at the upper end of which is fixed a roller: by the revolution of the wheel above, the three circular bars *r r r* attached to the wheel successively act upon the roller, and depress the crank *o*, which first raises the rod and weight *q*, and afterwards, as soon as the crank is relieved of the pressure, allows it to drop and strike the mould boxes, by which the bricks are discharged out of them. *s* is a box of cast-iron containing water, into which the mould boxes dip; *t* is a cushion, upon which they next fall in succession, by which the superfluous water is taken off; and *j* is a box of dry sand, into which the mould boxes afterwards fall; their surfaces in consequence becoming slightly coated with the sand, preparatory to becoming charged with clay.

The horizontal wheel *e*, worked by *d*, actuates the shaft *c* bearing the knives in the pug-mill. At the lower end of the shaft *c* is fixed a large circular revolving bottom plate *w*; the periphery of which, being furnished with teeth or cogs as shewn, take into the teeth of a circular revolving plate *v*, over which, as the mould boxes pass, the lower surfaces of the bricks become smoothed. At *x* is a small frame-work working up and down in a casing, with a pulley and counterbalancing weight like a sliding sash window; it is raised by the crank *y* as each mould box passes, when three little boards are placed across the frame from side to side by a boy for the reception of the bricks; when these are deposited by the means described the frame drops below the level of the endless strap *n*, the latter then receives them and carries them off to their destination. At *z* is fixed a flat bar, which acts as a guage to regulate the thickness of the stratum of clay revolving upon the bottom plate *w* of the pug-mill.

As the operation of this machine must be pretty well understood by the preceding description, we shall add but a very brief account of the process. The clay being worked in the ordinary manner through the pug-mill, it passes out at the "mouth" (on the side not shewn) from thence under a flap, which partly regulates the quantity in the bottom plate, and next under the guage which determines it precisely. A mould box having passed over the highest inclined plane, or "riser" *k*, first falls upon the stratum of clay, and chaps out three bricks, filling the moulds therewith by the false bottoms rising up to the determined point from the pressure of the clay against them: the mould with the bricks in them then slide over the polishing plate *v*, (which is kept wet by water from a tub constantly dripping upon it); from thence the moulds pass on to the frame *x*, when the weight *q* strikes against the protruded bolts of the false bottoms, and pushes out the bricks upon the boards on the frame; the frame then descends by their weight 2 or 3 inches and delivers the boards with the bricks upon the endless strap, which, being constantly in motion, carries the bricks away to be deposited on the backs. The mould box being discharged is then carried upon its roller up the first riser *k*, drops into the water, thence rising again, falls upon the cushion, next into the sand box, whence rising again up the highest inclined plane, being duly prepared, it falls again

upon the bottom plate of the pug-mill, and chops out three more bricks, during which period each mould box has operated in a similar manner.

---

## PATENT WOOD SCREWS.\*

*To the Editor.*

SIR,

I HAVE lately seen the article of "Patent Screws," and upon trial finding them very superior in every respect to those generally in use, I think the consumers of screws will feel obliged by your making them known through your very useful Register. The Patent Screws are perfectly round, and the heads are so true in figure as to appear to be turned in a lathe; the notch is exactly in the middle, and very deep, to allow the screw-driver to take firm hold. The worm appears geometrically true; the under side of it is an inclined plane, which facilitates the entrance into the wood, and the top side is quite flat, which increases the resistance. These screws may be screwed in and out as often as wished, and will never draw the wood; they also hold much firmer than a common screw of a size or two larger. The superiority in appearance when screwed in, will attract the notice of any consumer of screws. They are sold as low in price as the common screws, at Mr. Nettlefold's, No. 8, Red Lion Street, Holborn, where I procured mine.

Canterbury,  
June 16, 1826.

Sir, Your most obedient,  
S. I. JAMESON.

[As there is perhaps no article of more extensive utility in the mechanical arts of construction than wood screws, we feel obliged to our correspondent for having drawn our attention to the subject of this great improvement in their form. We happen to have a few of these "Patent Screws" by us, and from a close examination of their construction, we are fully persuaded our correspondent has not over-rated their merits. Viewing as we do the great importance of this little article being of a good quality, (for there is not less than a million of them used daily in this country alone) we shall be excused for adding a few observations as to their uses, and their comparative merits.

Of the two ordinary methods of uniting pieces of wood together, or other substances with wood, by means of nails and screws, the latter has the advantage of conferring vastly greater retentive power, without producing those fractures which frequently follow the driving of a nail. A nail, it should be observed, holds solely (when not clenched) by the pressure of the wood against its sides; and that this pressure may be as great as possible, the perforation, previously made by the gimblet for its reception, ought to be no larger than will insure the wood from splitting. The perforation for a screw is, or should

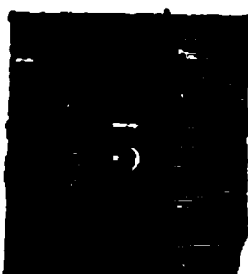
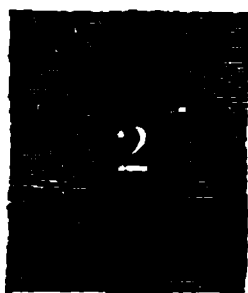
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\* [As a misconception of the meaning of this term sometimes arises, it is as well to notice, that by the term "wood screws" is not meant screws made of wood, but such as are adapted for screwing into wood, which are generally made of iron.]—ED.

be, generally of the diameter of the solid part of the screw within the thread, as it takes hold by inserting its coiled worm or thread laterally into the solid wood round the sides of the hole. Now if this operation be well performed with a good screw, its superiority over a nail, as a fastening, requires no comment: but it happens very commonly, from the wretched workmanship of the greater part of the wood-screws used, from the irregularity of the threads and the burrs upon them, that a nail, at a tenth part of the cost of a screw, is the best fastening of the two. For it may be readily conceived, that the turning in of a screw with such defects, only enlarges the hole, by tearing or rubbing the wood away before it, instead of inserting its thread regularly into the wood. It often happens that screws become loose in their holes even under the screw-driver, and this must invariably be the case, where the above-mentioned defects exist, which is indeed almost universally the case in a greater or less degree in our *common* wood screws. The employment of screws is much more expensive, and occupies more time than nails, and peculiar dependance is placed upon them as a secure mode of fastening.



Upon the whole it appears to us that the recommendation of our correspondent is not unworthy the attention of those of our readers who are consumers of screws, especially if this unquestionably superior article can be procured at the price of the ordinary sort. We have endeavoured to shew by the drawing in the margin, *Fig. 1*, the form of the thread of the Patent Screws. The diagram marked 2 may be supposed to be a sectional portion of the worm of a patent screw inserted in the wood, and to exhibit thereby the facility which the inclined plane of the lower side of the worm offers for its inserting itself into the wood (rendering it unnecessary in soft elastic woods to bore any hole at all) while the flat surface of the upper side being at right angles with the screw, taken lengthwise, bears against so large a portion of the solid intervening wood, as to present a very great resistance to its being pulled out.



The diagram marked 3 is intended to shew a similar portion of the ordinary screw, with its worm buried in the wood. An inspection of this figure will shew that this kind of screw, offers a much less resistance to its being pulled out, and it is equally obvious that when such a screw has the defects before mentioned, the security it offers is very slight indeed.

## HARCOURT'S PATENT SOCKET CASTORS.

THE advantages which have attended the employment of anti-friction rollers to castors of certain descriptions (in taking off the strain from the central pivot, and in relieving the surrounding parts from an excessive degree of friction), rendered it very desirable to contrive

their application to *socket* castors; such as are almost universally put to the feet of tables, and other descriptions of heavy household furniture; and this application has, we find, been made by Mr. James Harcourt, (brass-founder, of Birmingham) by a very simple and judicious arrangements of the parts.

*Figure 1*, annexed, gives a side view of the castor, the upper or socket part only being shewn in section; *a a* shews the guide plate, fixed round the central pin so as to revolve with it: this plate has circular holes made through it, in which as many little spherical metallic balls roll, as they are carried round with it; their upper sides pressing upon the false bottom *b*, and their lower resting upon the revolving bed *c* of the castor. By these means the strain and pressure upon the central pin is removed; the anti-friction rollers act very effectually, and the ordinary form of the castor is preserved.

*Fig. 2* gives the plan of the guide plate *a*, which may have three or more apertures for the anti-friction rollers; and these may be either cylinders or spheres; for which reason there are shown in this diagram one of the former, and two of the latter, in apertures adapted to their figure.

The expense of these improved castors is but little more than the ordinary kind, and they are calculated to last ten times as long, while they will always act much better.

## MEASURING OF CIRCLES.

*To the Editor.*

SIR,

I PERCEIVE from the circular shape of some of the figures delineated in your most valuable publication, that it would be a matter of some importance to those who construct circular pieces of mechanism, to be acquainted with the quadrature of circles, or the proportion which the diameter bears to the circumference, and *vice versa*, as it must be of great utility, particularly in very small cylinders, rollers, &c. inasmuch as certainty in the construction of mechanism is preferable to guess work, and more so when the true definition is much more brief than the false.

The method in general use is that laid down by Archimides upwards of 2000 years ago; but we should prefer giving place to modern inventions when they are found to be "quite correct" in preference to adhering to antiquated incongruities. I shall, therefore, put

Archimides' solution and my own in contradistinction, to be adopted or rejected at pleasure.

### ARCHIMIDES' SOLUTION.

As 7 is to 22, so is the diameter to the circumference, and *vice versa*.

$$\begin{array}{r} \text{As } 7 : 22 :: 15 \\ \hline 110 \\ 22 \\ \hline 7) 330,000 \\ \hline 47,142 \text{ \&c. } ad \text{ infinitum.} \\ \hline \text{Circumference.} \end{array}$$

$$\begin{array}{r} \text{As } 22 : 7 :: 47,142, \&c. \\ \hline 7 \end{array}$$

$$\begin{array}{r} 22) 329,994 (14,545, \&c. \\ \hline 22 \text{ diameter} \end{array}$$

$$\begin{array}{r} 109 \\ 88 \\ \hline 119 \\ 110 \\ \hline 99 \\ 88 \\ \hline 114 \\ 110 \\ \hline \end{array}$$

4 *ad infinitum*.

### MY SOLUTION :

As 5 is to 16, so is the diameter to the circumference.

$$\begin{array}{r} \text{As } 5 : 16 :: 15 \\ \hline 80 \\ 16 \\ \hline 5) 240 \\ \hline 48 \text{ Circumference.} \end{array}$$

$$\begin{array}{r} \text{As } 16 : 5 :: 48 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 4) 240 \\ \hline 4) 60 \\ \hline 15 \text{ Diameter.} \end{array}$$

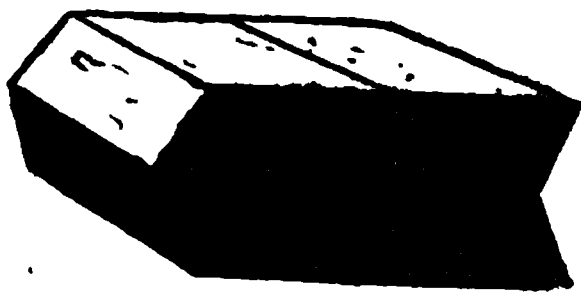
and so with any number

I trust, from the above definition which I have given, from its conciseness and accuracy for ascertaining the dimensions of circles, that it will be generally adopted. When the numbers come to be compared the utility must be obvious.

EPHRAIM SMOOTH.

### THE PATENT BIANGULAR PAVEMENT.

We have in our possession a lithographic prospectus of a new kind of pitched pavement, which we cannot conveniently at present have access to, but the following notice of the invention, extracted from the Quarterly Journal of Science, will probably suffice.

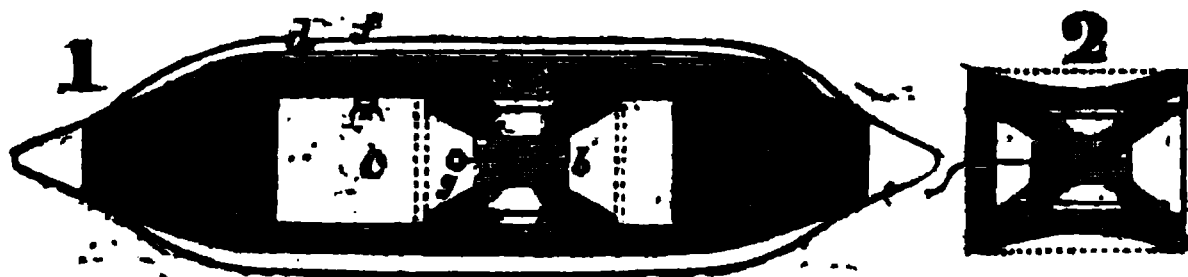


This mode of pitching pavement is founded; as the inventor states, upon the reciprocal bearing and support of the stones. The pavement is formed of granite or other hard paving stones, of the ordinary size, and each stone is laid or ranged in such a manner, with reference to the several contiguous stones, as that neither can be displaced the eighth part of an inch by any pressure or percussion, however great, in the ordinary use of the streets. The stones are not wedges or cubes, but formed as above; each contains a protruding or salient angle on the one side, and an indented or receding angle on the opposite side; the receding angle being formed to receive the salient one. In a prospectus put forth, the mode of pitching such a pavement, and raising a stone when required, is depicted and described. The inventor states, that its advantages will consist in its level symmetry and uniformity, its cleanliness, its strength and solidity, derived by each part from the whole superficies, facility when laying down and raising, and probable durability. The expense of thus cutting or dressing the stones is not mentioned. It is called the Biangular Pavement.

## GOSSET'S PATENT IMPROVEMENTS IN LOOMS.

THESE improvements wholly relate to some new forms and constructions of shuttles used for weaving various sorts of cloth; including those employed for weaving metallic cloth, or wire gauze. The patentee is Mr. Pierre Jean Baptiste Victor Gosset, of Clerkenwell Green, London.

In shuttles, such as are at present known and in use, great difficulties have been experienced in causing the thread or yarn to come off the bobbin or shuttle cap, with an uniform tension, without which it is impossible to produce a good and even cloth; but by the construction of the shuttle, and disposition of the bobbin therein, a regulating spring is applied for the purpose of creating the necessary resistance upon the bobbin, which spring is furnished with an adjusting screw, for increasing or diminishing its power, at the pleasure of the weaver; such changes becoming indispensable in the progress of weaving.



The annexed *figure, 1*, is a longitudinal section (cutting through the broadest side) of the improved shuttle, particularly adapted to the weaving of metallic fabrics, such as wire, or other stiff material.

*a a* is the body of the shuttle made of hard wood, and tipped with metal at the extremities, as usual; *b* is the bobbin or, weft roller, made like a pulley, and turning upon a polished pin passing through its axis, in the morticed cavity *c*, made in the side of the shuttle: the pin *b* is adapted to be taken out easily, that the bobbin may be removed or changed with facility as often as may be desired; *d* is the regulating spring before mentioned, the ends of which are bent round and fixed by driving them into the wood. To this large spring is fixed a smaller spring *e*, so curved as to bear and press upon the upper surface of the bobbin; at *f* is an adjusting screw, the head of which is sunk into the upper part of the regulating spring *d*, to prevent its becoming entangled with the threads of the warp; the point of this screw is inserted, and works in a *fixed* nut in the inside of the shuttle, so that when it is turned, the small curved spring is caused to press with more or less force upon the surface of the bobbin, thereby creating a greater or less degree of resistance for regulating the tension at which the yarn shall be drawn off the bobbin, and through the eye *g* of the shuttle.

The upper and lower surfaces of the shuttle are formed concave (as shown by *fig. 2*), in order that the head of the adjusting screw and regulating spring may be sunk within it, so as to prevent their coming in contact with the threads of the warp. The regulating spring is in some cases applied by the patentee, within the cavity *c*, when a hole is made in the upper part of the shuttle, for the insertion of a turn-screw, to operate upon the head of the screw *f*, and regulate the tension. By another modification the patentee forms the shuttle like a box; with a lid sliding in grooves, or hinged on; in which case the regulating spring is to be fixed on the lid, or one of the sides, so as to give the required pressure to the bobbin.

In weaving articles of stiff wire, with this improved shuttle, a casing or tube of some elastic substance is employed to surround the bobbin shewn by dotted lines: this tube has an opening or slit on one side for the wire to pass through; and by closely embracing the bobbin, prevents the coil of wire from unwinding, becoming loose, or entangled; and allows it to be drawn off evenly and regularly, as it may be required. When the wire is very stiff and hard, the patentee recommends the employment of a pair of small steel rollers, to be fixed near the eye-holes, by which means the wire will run out with considerably less friction.

The annexed form of shuttle is adapted to the weaving of fabrics of silk or any other material.



It is hollowed out, as described in the former, for the reception of the bobbins, which are three in number; these bobbins being

charged with the thread or yarn, may be worked one after the other with the same coloured thread, or with thread of different colours successively for weaving figured goods ; and when it is necessary to change the colour, it will only be necessary to break off the end of the weft done with, and draw the end of the other colour through its eye or opening. The springs and screws in this shuttle are similar to those described in the first mentioned shuttle, therefore need not be particularized again. Any number of bobbins may be employed in these shuttles, according as the nature of the work may render desirable.

These improved shuttles appear to possess a decided superiority over the ordinary kind, in many respects, and are consequently well deserving of the attention of manufacturers of all kinds of cloths, for which they appear to be equally adapted.

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### PLAN FOR DISPENSING WITH THE USE OF HORSES IN AGRICULTURAL LABOUR.

*To the Editor.*

SIR,

I HAVE for some time past entertained a notion of the practicability and possible eligibility of superseding the use of horses in ploughing and harrowing land, and had contemplated the application of a moveable crane or winch for the purpose, when, accidentally turning over the interesting pages of your Third Volume a few days since, my attention was very gratefully attracted by your account of the machine adopted by Mr. Mackay, of Picton, in Nova Scotia, for the purpose of drawing stumps of trees out of the ground in newly formed clearings. Of the immense utility of a machine of this nature in new settlements, I am fully apprised, have witnessed the extreme inconvenience to agriculture from the stumps of trees being left to decay by the process of time alone. So great, indeed, is the labour of grubbing up the stumps of trees considered in America, that it is rarely encountered, and the troublesome operation of burning the stump to the surface of the ground, and blowing up the roots with gunpowder is the method more generally resorted to. I am, however, of opinion, that the crane made use of by Mr. Mackay, though highly useful, is applicable only to trees of moderate dimensions, and that the power requisite to extract stumps of three or four feet diameter would be more than this crane is equal to ; but, nevertheless, suppose that an increase of power could be easily attained.

With regard to the power requisite to draw a plough through land of the toughest texture, no difficulty could exist. That of six or eight horses would be more than sufficient, and by its superiority to the degree of power than was required, would enable the plough to be drawn through the surface with any discretionary increased motion to that of the walking pace of horses, and at the same time by the steady draft from the cylinder of the crane, give an improved motion to the plough, when compared with the jerking motion of horses. The difficulty in the application of two cranes in opposite

sides of a field, similar, in principle, to that used in Nova Scotia, for extracting stumps from the ground, seems to be, first, in acquiring a purchase in the line of draft throughout the sides of the field; and, secondly, in the construction of apparatus by which each of the cranes should be regularly moved the width of a furrow; a chain, equal to the length of the space between the cranes, being attached to each of them, the plough being hooked to these chains alternately, every time it was drawn across the field. My principal doubts of the practicability of this use of the crane, arises from the difficulty of procuring the requisite purchases for the cranes on the sides of the field, but when the immense economy of horse labour, and of time, that would result from this mode of ploughing, is considered, the first obstacles that present themselves, should not, I think, be hastily considered as insuperable.—Another use of these machinery might be, the drawing the crops when reaped or cut, to the sides of the field, ready for loading; and if small low-wheeled carriages were used, and made to run upon a rail-way, a great diminution of the labour of harvesting might be effected.

The application of machinery to diminish the use of horses in husbandry, appears to be a great desideratum, especially if the position of some eminent political economists be correct,—*that one horse requires as much land for the production of its food, of all kinds, as would support a family.*

The application, however, which I at present contemplate, would comport only with freeholders, and occupants with extended tenures, as the expense attending so great an innovation of ancient practice would be great. Supposing, however, that I was a freeholder; that I had perfected my cranes, together with a rail-way for them to move in by means of wheels or rollers, and had determined to cultivate my estate by inert machinery wholly, I should take my map, and, leaving all the boundary fences untouched, draw the largest square or parallelogram within these that I judged convenient. I should then draw parallel lines through this square, or quadrangle, to form as many divisions of the land into fields, as I considered desirable. I should then commence operations on the land by establishing lines to correspond with those on the map, demolishing the whole of the interior fences and hedge-rows, excepting such of the trees in them as might be rendered serviceable, by which a vast acquisition of ground for tillage would be made. I should then set up strong fences of timber and iron combined, the lower bars of which should be notched or grooved, so as to regulate the furrows of the plough. As the purchase procured by the cranes being confined within a railway would be considerable, the strength of the fences might be rendered proportionate. A few experiments, however, on tough or heavy soils, would soon determine the requisite strength of both united. In light soils this mode of ploughing would admit of a celerity of motion altogether incompatible with horse labour. I suppose that two men would be necessary to attend each crane, and one to accompany the plough, to guide it and remove obstructions. The shifting of the plough from the furrow drawn into the position

to begin another, together with the shifting of the chains, should, if necessary, be the joint motion of the three men at either side of the field, and would soon be effected with the utmost ease.

It would be necessary for the plough every time it crossed the field, to take back the chain by which it was drawn to either of the sides, by which means the cranes would deliver each other.

It might be said, that such a mode of cultivation would be highly at variance with an attention to the picturesque: granted, Mr. Editor, but for an attention to the picturesque I would substitute another of a social or political kind; I console myself for the loss of hedge-rows, by considering how far the measure would give a new impetus to human industry, and an increased supply to human wants, by a diminished use of horses in agricultural labour. Should the foregoing hints be deemed of any value, they are entirely at your disposal, either for insertion in your valuable Repository of Art, or otherwise, as you may think proper.

Finbury,  
29th June, 1826.

I am, Sir,  
Respectfully yours,  
W. T. H.

Although the writer of the preceding letter, is decidedly in error with respect to the useful application of the crane in drawing the plough, we think it probable that the promulgation of his novel and ingenious ideas, as connected with the important objects he has in view, (viz. the giving of "a new impetus to human industry, and an increased supply to human wants,") may lead to the projection of some improvements which will give it a feasible character: and we have for this reason felt ourselves bound to give insertion to the communication, notwithstanding the whole plan is founded upon an erroneous supposition with regard to mechanical power. This error we will first endeavour to shew in a simple way, and shall afterwards suggest what strikes us at present as an improvement upon the plan of our correspondent.

We will suppose that a field 100 yards wide, of very light soil, requires two horses only to plough it of the required depth. Now it has been ascertained that the force exerted by a horse thus drawing at the rate of about 2 miles an hour is equal to the drawing up of a weight over a pulley of 150lbs.; the united force employed would therefore be 300lbs., and the time occupied in making a furrow of 100 yards, about  $2\frac{1}{2}$  minutes. If we now remove the horses, and apply the crane with manual labour, we shall first find that a man can exert in turning a winch a force equal to only 30lbs. consequently it will take *ten* men at the winch to move the plough 100 yards in  $2\frac{1}{2}$  minutes. If *power* be added (as it is incorrectly termed) by lengthening the lever, by reducing the diameter of the barrel, or by the addition of a wheel and pinion, or any number of wheels and pinions, nothing whatever will be gained towards the ploughing of the field; for although *one* man may thus be enabled to move the plough through the soil, he will only move it a tenth part of the distance, or *ten* yards in the  $2\frac{1}{2}$  minutes, proving thereby the truth of the common

saying "what is gained in power, is lost in time;" but we can in point of fact gain no power at all, the whole gain in the application of manual strength to machines, is *convenience*. A man, by applying a force of 100lbs. to a lever may move a stone of a ton weight; but in effecting this movement the 100lbs. has been moved through 20 times the space of the stone; consequently, if the stone were divided into 20 pieces, the 100lbs. power applied in the first instance to the lever, might as well be devoted in removing the 20 pieces of the stone separately, to the same distance as they were moved by the lever: the *convenience* of a machine, therefore, consists in being able to move very slowly masses of great weight which we could not without the aid of art, move at all.

With these evident truths our intelligent correspondent, and our readers generally we doubt not are fully sensible, we therefore conclude that the crane or winch, however judiciously employed in rooting up trees, cannot be employed with the least advantage in ploughing: what we require as a substitute for horses is a more economical power.

If a railway were to be made (as proposed) to intersect a large parallelogram, divided into numerous fields, we think a machine on the principle of the treadwheel might be advantageously employed, which could be moved from field to field, and temporarily fixed by means of bolts, on a spot previously determined and prepared for its reception. Now the ordinary weight of a man is at least 150lbs. and by treading on boards upon the periphery of the wheel, he would apply the force of his whole weight, which is of itself equal to the average power of a horse in drawing; thus four or five men might plough the heaviest soils without horses, and with equal celerity. There would be no occasion for two machines, one on each side of the field; as a pulley on one side would enable the plough to be drawn in either direction.

As the idea of employing a treadwheel for the purposes of agriculture may be thought somewhat horrifying, we have next to propose *steam engines* mounted on low wheels, which may be temporarily fixed at the appointed stations for drawing the various implements, such as ploughs, hoes, harrows, &c. across the fields.

The power of a steam engine it is well known is more economical than that of horses; and when it is considered that the latter must be fed all the year round, and the former only when at work, the eligibility of employing steam engines in agriculture, seems to be really entitled to serious consideration, especially under the facilities proposed by our correspondent.]—*Ed.*

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## Discoveries & Processes in the Useful Arts.

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ON A FACTITIOUS SILVERING OR GILDING USED IN INDIA. By JOHN ROBINSON, Esq. F. R. S. E.—The Mochees and Nuquashes of India, who are the makers and painters of a variety of objects,

whose purposes require ability to stand the effects of the weather, use an application, in ornamenting their work, which, in appearance, nearly equals gilding, and costs little more than common paint. It appears to me that this application might be useful in some cases, in this country; particularly in chain-bridges, and other works where iron of a smooth surface is exposed to the atmosphere. I use the freedom, therefore, of troubling you with what I recollect on the subject.

In preparing the factitious silvering or gilding in the small way, a quantity of pure tin is melted, and poured into a joint of bamboo, (perhaps a foot long, and two or three inches in diameter,) close at both ends, except the perforation at which the tin is poured in, which is instantly plugged up. The bamboo is then violently shaken, which, if well managed, soon makes the metal assume the form of a *very fine* gray powder; this being sifted, to separate any coarse particles, is mixed up in thin melted glue, and, if I recollect right, is levigated on a stone with a muller. The result is poured into dishes (commonly cocoa nut shells) to settle, and the superfluous moisture poured off.

When, to be applied, it should be of the consistence of thin cream; and is laid on with a soft brush, like ordinary paint. When dry, it appears like a coat of common gray water-colour. This is gone over with an agate-burnisher, and then forms a surface of polished tin; a coating of white or coloured roghun (oil varnish) being immediately laid over it, according as it may be intended to imitate silvering or gilding.

I have had tent-poles, travelling trunks, baskets, covered with painted leather, and other articles, in constant wear and tear for years; in which, from its cheapness, this mode of ornamenting had been very liberally applied; and have often had occasion to remark the power which it appeared to have of resisting the effects of the weather.

On a first trial, some difficulty of manipulation may be found, in bringing the tin to a sufficiently impalpable powder, and also in hitting the proper quantity of glue to be put in. If the size be too strong, the agate has no effect; and if too weak, the tin crumbles off under the burnisher. A very little practice will make the process exceedingly easy.—*Edinburgh Philosophical Journal*.

**GLUE FROM TANNED LEATHER.**—It is generally thought that the process of tanning renders leather exceedingly insoluble. Means, however, have been found to overcome that insolubility, and to form a glue exceedingly well-adapted to the purpose for which it has hitherto been used; namely, that of making the *black paper cases*, so much used for a great variety of purposes; as it not only forms the cement by which they are glued together, but also, in consequence of the gallic-acid contained in it, strikes a black colour, by the application of a solution of sulphate of iron (green vitriol, or copperas) to the surfaces of the articles; and lastly, serves to varnish the cases.

The process for making this glue is as follows:—Boil the scraps

or cuttings of thin tanned leather; such as the upper leathers of boots, shoes, &c. are made of, in stale urine, until they become softened, and will stretch and contract, when pulled and let go again, in the manner of India-rubber: they are then to be washed in clean water, and boiled in water until dissolved to a proper consistence for use.

It is very singular that this useful process has been hitherto confined to the above branch of manufacture; and has never, to the best of the Editor's knowledge, been before published.—*Gill's Technical Repository.*

**IMPORTANT SURGICAL INSTRUMENT.**—M. Thibault, (de l'Orne) a young medical professor of great distinction in France, has just presented to the Academy of Surgery, in Paris, a paper in which he describes a new method of dissolving the stone in the bladder. A most ingeniously-constructed instrument conducts into the bladder a little pocket, very thin in its texture, but capable of resisting the action of the strongest acids. By an admirable mechanical contrivance the stone is inclosed in the pocket, which is subsequently closed in such a manner as to prevent the possibility of the escape of any of the liquids that are injected into it. The action of the dissolvents, powerful in itself, is augmented by the electrical current of the voltaic pile, which alone is capable of dissolving the hardest bodies. This paper has excited a great sensation, and the report of the Academy upon it, which will no doubt contain the details necessary to the elucidation of this most valuable invention, is expected with considerable impatience.

**SULPHATE OF QUININE.**—The high price of this valuable medicine has tempted the cupidity of counterfeiters, and what is more remarkable, one of them had the audacity to request M. Pelletier, of whom he purchased this article, to prepare for him some sulphate of lime (which, as is well known, crystallizes in silky fibres) in order to mix it with sulphate of quinine. This, then, is one method of adulteration. Others have substituted carbonate of magnesia. These frauds are easily discovered: for it is sufficient to treat the sulphate of quinine with alcohol, which dissolves it entirely; whilst the two other salts remain insoluble, and washed with cold water are insipid.—*Bul. de Sciences.* August, 1825.

**SOUNDS PRODUCED UNDER WATER BY THE TRITONIA ARBORESCENS.**—Dr. Grant has remarked the production of sound by these animals under water. The sounds they produce, when in a glass vessel, resemble very much the clink of a steel wire on the side of the jar, one stroke being given at a time, and repeated at intervals of a minute or two. These sounds are obscure when the animal is placed in a large basin of water, but in favourable circumstances they may be heard at the distance of twelve feet. They are longest and most frequent when the *tritoniae* are lively; no globule of air escapes to the surface of the water, nor is any ripple observed there. The sounds obviously proceed from the mouth of the animal! and at the instant of the stroke the lips are suddenly observed to separate, as if to allow

the water to rush into a small vacuum formed there. Dr. Grant has preserved these animals alive for a month together, giving them fresh water every day, and occasionally fresh branches of the *sertularia dichotoma*. They have continued to emit sounds during the whole of the period.—*Edin. Phil. Journal*. xiv. 185.

### LIST OF NEW PATENTS, SEALED 1826.

**SCREW PRESS.**—To Daniel Dunn, of King's Row, Pentonville, Middlesex, for an improvement upon the screw press. 23rd May. Six months for enrolment of specification.

**DAMAGED WHEAT.**—To Thomas Hughes, of Newbury, Bucks, for a method of restoring foul or smutty wheat, and rendering the same fit for use. 23rd May. Six months.

**SPINNING.**—To F. Molineaux, of Stoke, Somerset, for improvements in spinning machinery. 23rd May. Six months.

**WHEEL CARRIAGES.**—To T. P. Birt, of the Strand, London, for improvements in wheel carriages. 23rd May. Two months.

**PARK GATES.**—To John Parker, of Knightsbridge, for improvements on, or additions to park, or other gates. 23rd May. Six months.

**COOLING WORT.**—To D. P. Deurbroucq, of Leicester Square, for an apparatus to cool wort or wash, previous to its being set to undergo the process of fermentation. 23rd May. Six months.

**WEAVING.**—To W. H. Gibbs, of Castle Court, Lawrence Lane, London, and Abraham Dixon, of Huddersfield, Yorkshire, for a peculiar kind of piece goods, displaying a novel combination of colours. 23rd May. Six months.

**STEAM ENGINES.**—To Louis Joseph Marie, Marquis de Comblis, of Leicester Square, for certain improvements in the construction of rotatory steam engines, and the apparatus connected therewith. 23rd May. Six months.

**WINDOW BLINDS.**—To James Barlow Fernandez, of Norfolk Street, Strand, for improved blinds or shades for windows, &c. 26th May. Six months.

**MOTIVE ENGINES.**—To Robert Mickleham, of Farnival's Inn, London, for certain improvements in engines moved by the pressure, elasticity, or expansion of steam, gas, or air, by which a great saving of fuel will be effected. 6th June. Two months.

**WINDING MACHINE.**—To Henry R. Fanshaw, of Addle Street, London, for his invention of an improved winding machine. 13th June. Six months.

**ACETIC ACID.**—To John Ham, late of West Coker, but now of Holton Street, Bristol, for an improved process for promoting the action of acetic acid on metallic bodies. 13th June. Six months.

**ORNAMENTAL METALS.**—To Thomas J. Knowlys, of Trinity College, Oxford, for an imported invention of a new manufacture of ornamental metal or metals. 13th June. Six months.

**STOCKING FRAMES.**—To Joseph Smith, of Tiverton, Devon, for an improved machinery used in the making of stockings, &c. 23rd May. Six months.

**SASH FASTENING.**—To John Leach, of Birmingham, for a self-acting sash-fastener, which is applicable to other purposes. 23rd May. Six months.

**CARRIAGE SPRINGS.**—To R. Slagg, of Kilnhurst-forge, near Doncaster, Yorkshire, for an improvement in the manufacture of carriage springs, &c. 23rd May. Six months.

### TO CORRESPONDENTS.

The subject of J—m—y's communication is of the highest interest; but the want of clearness in his argument and conclusions, compels us to decline its insertion.

H. L. and Pro Bono Publico will have early insertion.

TIPTON MECHANIC is not forgotten: the delay has arisen by our not having had occasion to go lately within three miles of the place from whence the subject is to be obtained.

The List of Expired Patents will be given in our next.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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KENDALL'S PATENT DOMESTIC POWER LOOM.

VOL. IV.

I

**KENDALL'S PATENT DOMESTIC POWER LOOM.**

**POLITICAL** economists lay it down as an axiom, that the employment of machinery which tends to lessen the necessity of manual labour, and at the same time causes an increase in the productions of a country, must be a national benefit; inasmuch as the articles, being thus produced with greater facility, are thereby rendered cheaper, which consequently induces a greater consumption, and an increased demand for labour. Without subscribing unconditionally to the truth of this doctrine, as applied to the existing order of things in this country, we shall only say that if the assumed position be incontrovertible, then the machine we have to describe appears to us to be one of the greatest public benefits derived from mechanical genius since the days of Arkwright. But with questions of political economy we have really nothing to do; our business is with the merits of the invention brought under our notice, to which we have been led by the solicitations of numerous correspondents, desirous of obtaining full information upon the subject. As compilers of a work which professes to give a description of every new mechanical invention of importance, we felt it our duty to comply with these solicitations, and we accordingly called upon the patentee, Mr. Kendall, of No. 8, Paternoster Row, St. Paul's, from whom we received the politest attention, and were permitted to make original drawings from one of his domestic power looms, engravings from which we present herewith to our readers.

In a brief description of this loom, which was given in the Times Newspaper of the 24th of June,\* the following observations are made as to its powers :—

“ This loom is effectual and simple; a boy of 12 years of age, with a proper fly wheel, would find no difficulty in turning six or eight of them. The number of looms one weaver is capable of working must depend on two principal objects. The quality of the goods manufactured, and the quality of the materials made use of, varying from two to five looms, such as persians, sarcenets, levantines, and poor satins, which, with good materials, require little attention. Rich works, with an able weaver and good materials, will be able to work two looms, with an addition of some light work before mentioned. The work is, of course, better than that performed according to the old plan by hand; the machine acting more steadily, and operating with less of stickings.”

There being two looms in the room where our drawings were made, an opportunity was afforded us by the patentee, of weaving, unassisted, two pieces of silk at a time, which we effected with a

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\* We by no means approve of the strictures which accompanied the above observations, in the Times, upon Dr. Birkbeck's omitting to notice Mr. Kendall's loom in the Lecture previously delivered at the London Mechanics' Institution, on the subject of Weaving: as to our knowledge, the worthy Doctor undertook and performed a most laborious task in treating upon the subjects already prepared for him, which alone caused the lecture to be extended to an unusual length, as will be seen on reference to our report of that interesting Lecture contained in our 78th Number.

very slight application of the force of one hand. From this circumstance it is evident, that the gear, by which the power is communicated, and the apparatus by which the several motions of the loom are produced, must be of great simplicity, of very little weight, and their action peculiarly smooth and uniform.

Viewing the loom distinctly from the power applied, it is in all respects of the same construction, and operates exactly the same as the common hand loom, and every description of fabrics can in like manner be woven by it: herein, practical men say, consist one of its chief excellencies; for a weaver, who has never seen a power loom in his life, may at once proceed, without any instruction, to arrange the several matters preparatory to the act of weaving, in the manner he has been accustomed; and afterwards see all the combined and successive movements in weaving executed with the utmost precision by the turning of a winch, by which also any number of looms may, at the same time, be worked simultaneously and with equal regularity. It also follows, from the lightness and simplicity of the machines, that their construction must be attended with very little expense, and, from this circumstance, there is reason to hope that the ingenious patentee will reap some solid advantages during the term of his patent, and at the same time be enabled to afford the looms at a trifling additional cost above those of the ordinary kind, whose powers of production are so circumscribed.

We shall now proceed to explain the several parts lettered in the diagrams, and afterwards more particularly their use and application.

*Reference to the Engravings*—The frontispiece represents a front view of the domestic power loom; in which all the principal parts may be seen; *a a a*, is the framing, *b* is a revolving shaft or bar, which is put in motion by the action of a pinion (particularly shewn by Fig. 3), taking into the spur wheel *c*: *d* and *e* are two cams which act upon the levers *i i*, the same being connected to the spiral spring *w*, to give motion to the shuttle. *f f* are two wipers, which operate on the batton lever *k*. *g g* are two other wipers, acting upon the two treadle levers *h*. *l l* are the tumblers, which raise and depress the harness. *m m* are the swords of the battons. *n n* are two vertical rods in connection with the shuttle. *o o* is the box or shuttle-race. *p p* are the drivers sliding upon horizontal wires, which immediately propel the shuttle. *q* is an iron bar, carrying various levers as above-mentioned. *r* is the front bar supporting the brackets which carry the vertical rods. *s* is the breast roll. *t* the long marches. *v* the short marches. *x* is the harness and heddles. *y*, the reed or lay. *z*, the cords connecting the two treadles with the long marches. *z 1*, the cords connecting the long with the short marches; and *z 2*, those which connect the long marches with the tumblers. The several small spiral springs represented are for the purpose of giving steadiness and the necessary tension to the parts with which they are connected.

Fig. 2. represents a series of treadles (which may consist of any number as required), with the end view of an additional bar, which it is necessary to introduce when the weaving is of such a nature as

to require the operation of more than two treadles ; in the former figure (the frontispiece), is shewn a series of notches or bearings for these treadles (marked 2 upon the bar *g*, Fig. 1 ;) this bar in Fig. 2, is shewn equipped with four wipers *a*, which act successively upon the four treadles *c* beneath.

The intention of the diagram, Fig. 3. is to shew the method adopted by the patentee for throwing the revolving shaft in and out of gear, and likewise to exhibit the mode by which the power is applied. *d* is the box of the batton. *e* is a small bent lever, attached to the box. *f* is a sliding bolt connected to a latch, *g*, by a cord. *h h* is a long right angled lever, furnished at the extremity with an inclined plane, for the purpose of putting the wheel *k* in and out of gear. *i* is the lever connected with the clutch, and is operated upon by the lever *h*.

The action of this machine is wholly effected by the revolution of the bar *b*, Fig. 1, in the top of the loom, which, as already described, is equipped with four wipers and two cams or snails. The two central wipers, *ff*, as they revolve, operate on the lever *h*, and

move the batton, *m m*, as required ; the two cams, *e d*, right and left, act alternately on a lever each, *i i* ; the reverse ends of these levers are connected to two vertical rods *n n*, suspended from a bracket in front of the loom ; these levers, *i i*, are likewise connected by a spiral spring *w*, that the action of the cams at the necessary periods may cause the springs to become charged, at the time the levers, in traversing the cams, meet with a sudden declension or fall, when the distended spring suddenly contracts, and drives the shuttle across the work. The other two wipers, *g g*, act upon two treadles, *h h*, to make the shed or opening for the passage of the shuttle ; one revolution of this bar completes two shutes, causing these cams and wipers to act uniformly with each other, and to perform the whole operation required in simple weaving.

In order to accomplish more complex weaving, when more than two treadles are required, a second bar is introduced, equipped with as many wipers as treadles wanted ; the wipers being placed at equal distances on the circumference of the bar. If four are necessary, as the principal bar in making one revolution, acts upon the treadles twice ; therefore, in order to work over the four treadles upon the second bar, the principal bar in this case must make *two* revolutions to *one* revolution of the secondary bar. If five treadles be required, the principal bar must make  $2\frac{1}{2}$  revolutions to one of the secondary bar ; and so on to any number of treadles used in " plain complex weaving." The uniform motion of the two bars are regulated by cog-wheels upon their axes, which are adapted according to the nature of the work. If a greater number of treadles are required, more than this or the hand loom is able to accomplish with ease, it only requires the aid of the jacquard, mounted upon the loom, to simplify the " complex figured weaving."

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#### PATENT GRANTED TO W. CHURCH, Esq. OF BIRMINGHAM, FOR IMPROVED MODES OF CASTING METALLIC CYLINDERS, TUBES, AND OTHER ARTICLES.

THE new methods of casting introduced by the patentee, appear to us to constitute some very important improvements in the art of founding, being calculated to produce perfectly sound castings of a uniform solidity, free from *air holes*, *flaws*, and from the very common defect called *honeycomb*.

The process consists in exhausting the air from the moulds by means of an air pump, and afterwards in forcing the fluid metal from an air-tight reservoir beneath, upward into the mould by the aid of a condensing pump. As the apparatus for this purpose may be constructed in a variety of ways, and be adapted to the description of articles to be cast, the patentee has described only one arrangement, which he adopts and recommends for the purpose of casting large cylinders, rollers, or cannon, &c.

The mould prepared for casting is enclosed in a cast-iron air-tight casing, and suspended in a vertical position, by means of chains

to the jib of an ordinary crane, over the vessel containing the fluid metal; to the lower end of the mould, an earthen tube (the material similar to the crucible ware), descends, and forms the channel for conveying the metal upwards into the mould at the proper period of time: this earthen pipe is covered with a cap at its lower extremity, which is luted to it so as to be air-tight, and the material and thickness of the cap is such, that it will melt a short time after being immersed in the fluid metal.

As soon as the metal has arrived at the proper temperature, the suspended mould, with its appendage as before mentioned, is lowered by means of the crane, so that the earthen tube is immersed into the liquid metal, in the chest beneath; this metal chest is then closed air tight with a flange fixed on the upper part of the earthen tube, by proper contrivances for that purpose; such as a conical rim, an elastic metal hoop and luting; the perfect closing of which is effected by the pressure of the mould in its descent to its seat on the top of the metal chest.

The apparatus so far prepared, is next connected by short pipes with union joints, to pipes leading from an air-pump of large dimensions, which both exhausts and condenses. First, the air is exhausted from the mould, and from above the surface of the melted metal in the chest; by this time the cap of metal at the lower end of the earthen tube, becomes fused, the fluid metal ascends that tube, and is then forced by the condensing operation of the air pump into the mould above, which being previously exhausted, the metal is uniformly pressed into every cavity. As the vacuum in the mould is of course imperfect from the previous exhausting operation, and the remaining portion of air becomes condensed by the rising of the metal, to prevent any ill effects from its pressure, a stop-cock communicating with the exhausting end of the air pump, is opened, by which it is withdrawn.

The patentee has likewise provided a means of rapidly cooling the mould after being filled with the liquid metal; this consists in surrounding the cast iron mould case with an outer casing or jacket, with a vacant space between, which is charged with cold water whenever desired: in some castings the application must be of great utility in hardening their surfaces.

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### JENNINGS'S PATENT IMPROVED PROCESS IN REFINING SUGAR.

We are gratified in noticing that a very elegant improvement in the art of clarifying raw sugar, has been introduced by the scientific and ingenious Mr. Henry Constantine Jennings, chemist, of Devonshire Street, Portland Place. It is founded upon the fact, that alcohol possesses a much stronger affinity for colouring matter than for the saccharine principle. As the efficacious application of this property in alcohol cannot be doubted, the question resolves itself simply into the economy of the process, which, in substance, is thus described in the specification.

Raw or Muscavado sugar to the extent of from five hundred to one thousand pounds weight at a time, is to be put into a conical vessel, having an aperture at bottom covered with wire gauze: the rectified spirits obtained either from rum, wine, brandy, or any other liquor, is then to be poured into the vessel, which, as it percolates through the sugar, carries off the colouring matter and other impurities, through the aperture at bottom. When the spirit has ceased to drip, about thirty gallons of saturated syrup may be poured upon the mass of the sugar, which, penetrating through every part, takes up the remaining spirit, and leaves the sugar in that moistened state in which it is put into hogsheads to be ready for the market. The process of percolation may be expedited by hydrostatic, hydraulic, or any of the usual means resorted to, for forcing liquids through compact substances, whose particles are not in a state of actual cohesion.

The patentee limits his claim of invention to the application of rectified spirits, consisting for the most part of alcohol, for the purpose of refining sugar; such application having been found by him to operate more rapidly and effectually than any other liquid heretofore employed.

As respects the *economy* of the process, we should not omit to notice, that the spirit which has combined with the colouring matter, the water, &c. may be used over again in clarifying inferior sugar, and when it has become too thick, or too much charged with colour for the operation, the pure spirit is easily recovered by rectification. The prime cost or value of rectified spirits, and the expense of recovering them after having been used in refining the sugar, must be matters of such trifling consideration in the colonies where sugar is prepared, that we hesitate not to believe this new process will be extensively adopted.

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VARIATIONS IN THE ATMOSPHERE.—Monday last, the 17th., was the day agreed upon by the scientific throughout Europe, to register the correct state of the barometer, thermometer, and hygrometer, at every hour of that day; from which much important information is expected, particularly as to the relative heights of the situations of the observers, as well as some interesting facts respecting the variations of pressure in the atmosphere; it is to be hoped that all persons who may be in possession of instruments will have availed themselves of the opportunity.

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## ON THE LITRAMETER.

BY ROBERT HAHE, M. D. PROFESSOR OF CHEMISTRY IN THE  
UNIVERSITY OF PENNSYLVANIA.

THIS name is derived from the Greek *litra*, weight, and *meter*, measure; and is given to one of the instruments which I have contrived for ascertaining specific gravities. The litrameter owes its

efficiency to the principle, that when columns of different liquids are elevated by the same pressure, their weights must be inversely as their gravities.

Two glass tubes, of the size and bore usually employed in barometers, are made to communicate internally, with each other, and with a gum elastic bag, (G) by means of a brass tube and two sockets of the same metal, into which they are severally inserted. The brass tube terminates in a cock, to which the neck of the bag is tied. Between the cock and the glass tubes, there is a tube at right angles to an opening, into that which connects them. At the lower end of this tube, a small copper rod (R) enters through a collar of leathers.

The tubes are placed vertically, in grooves, against an upright strip of wood, tenanted into a pedestal of the same material. Parallel to one of the grooves, in which the tubes are situated, a strip of brass is fastened; and graduated, so that each degree may be about equal to  $\frac{1}{10}$  of the whole height of the tubes. The brass plate is long enough to admit of about 140 degrees. Close to this scale, a vernier (v) is made to slide, so that the divisions of the scale are susceptible of sub-division into tenths, and the whole height of the tubes, into about 3200 parts or degrees.

On the left side of the tube there is another strip of brass, with another set of numbers, so situated, as to comprise two degrees of the scale above-mentioned in one. Agreeably to this enumeration, the height of the tubes is, by the aid of a correspondent graduation on the vernier, divided into 1100 parts or degrees.

A small strip of sheet tin (*k*) is let into a kerf in the wood, supporting the tubes, in order to indicate the commencement of the scale; and the depth to which the orifices of the tubes must extend. At distances from this, of 1000 parts, and 2000 parts, (commensurate with those of the scale) there are two other indices, (T T) to the right hand tube. Let a small vessel, containing water, be made to receive the lower end of the tube, by the side of which the scale is situated; and a similar vessel of any other fluid, whose gravity is sought, be made to receive the lower end of the other tube; so that the end of the one tube may be covered by the liquid in question, and the end of the other tube by the water.

The bag being compressed, a great part of the contained air is expelled through the tubes, and rises through the liquids in the tumblers. When the bag is allowed to resume its shape, the consequent rarefaction allows the liquids to rise into the tubes, in obedience to the greater pressure of the atmosphere without. If the liquid to be assayed be heavier than water, (as, for instance, let it be concentrated sulphuric acid,) it should be raised a little above the first index, at the distance of 1000 degrees from the common level of the orifices of the tubes. The vessels holding the liquids being then removed, so that the result may be uninfluenced by any inequality in the height of the liquids, the column of acid must be lowered, until its upper surface coincide exactly with the index of 1000. Opposite the upper surface of the column of water, the two first numbers of specific gravity of the acid will then be found; and, by duly adjusting and inspecting the vernier, the third figure will be ascertained. The liquids should be at the temperature of 60.

If the liquid under examination be lighter than water, as in the case of pure alcohol, it must be raised to the upper index. The column of water, measured by the scale of 1000, will then be found at 800 nearly; which shews, that 1000 parts of alcohol are, in weight, equivalent to 800 parts of water: or, in other words, 800 is ascertained to be the specific gravity of the alcohol.

The sliding rod and tube at *r*, between the cock and the glass tubes, facilitates the adjustment to the index, of the column of liquid in the right hand glass tube. When the rod is pushed in, as far as possible, it causes a small leak, by which the air enters; and the columns of the liquids, previously raised too high by the bag, may be allowed to fall, till the liquid, which is to be assayed, is near the index: then, by pushing the rod in, they may be gradually lowered, and adjusted to the proper height, with great accuracy.

A rod of this kind, graduated, might answer the purpose of a vernier.

Instead of a simple bag of caoutchouc, I have used one with two valves; one opening from the tubes into the bag, the other from the bag into the air.

But, upon the whole, I find a syringe preferable; the adjusting rod being included in the rod of the piston, which is perforated for its reception, and furnished with a stuffing box, to render it air tight.

The plummet *p*, and the screws at *l*, enable the operator to detect and rectify any deviation in the instrument, from perpendicularity.—  
*Franklin Journal.*

### THE HYDROSTATIC BLOWPIPE,

Invented by R. HARR, M. D. and now used in the Laboratory of the University of Pennsylvania.

THE following passage is quoted from a memoir on the supply and application of the blowpipe, which I published in 1802 :—

“ The blowpipe is, on many occasions, an useful instrument to the artist and philosopher. By the former it is used for the purpose of enamelling, to soften or solder small pieces of metal, and for the fabrication of glass instruments ; while the latter can, by means of it, in a few minutes, subject small portions of any substance to intense heat ; and is thus enabled to judge of the advantage to be gained, and the method to be pursued, in operations on a larger scale. It is by means of the blow pipe, that glass tubes are most conveniently exposed to the heat necessary to mould them into the many forms occasionally required for philosophical purposes ; and by the various application of tubes, thus moulded, ingenuity is often enabled to surmount the want of apparatus, which is the greatest obstacle to the attainment of skill, in experimental philosophy.

“ To all the purposes which I have mentioned, the blowpipe is fully adequate, when properly supplied with air, and applied to a proper flame : but it appears that the means which have hitherto been employed to accomplish these ends, are, more or less, defective.

“ The most general method is that of supplying this instrument with the breath. In addition to the well known difficulty of keeping up a constant emission of air during respiration, and its injurious effect upon the lungs,\* it may be remarked, that as the breath is loaded with moisture, and partially carbonized, it is proportionably unfit for combustion ; and the impossibility of supporting a flame with oxygen gas, by this method, is obvious.

“ Another way of supplying the blowpipe with air, is that of connecting with it a small pair of double bellows. A contrivance of this kind, possesses obvious advantages over the mouth blowpipe ; but, owing to the pervious nature of the materials of which bellows are constructed, and the difficulty of making their valves air tight, the greater part of the air drawn into them, escapes at other places than the proper aperture. A pair of bellows of this kind, belonging to an artist of this city, which were not considered as less air tight than usual, were found to discharge the complement of their upper compartment, in six-sevenths of the time, when the orifice of the pipe was open, which was requisite when it was closed. Hence, it appears that six-sevenths of the air ejected into the upper compartment, escaped at other places than the proper aperture ; and, if to this loss were added that sustained by the lower compartment, the waste would be much greater. As, in operating with these machines, it is necessary

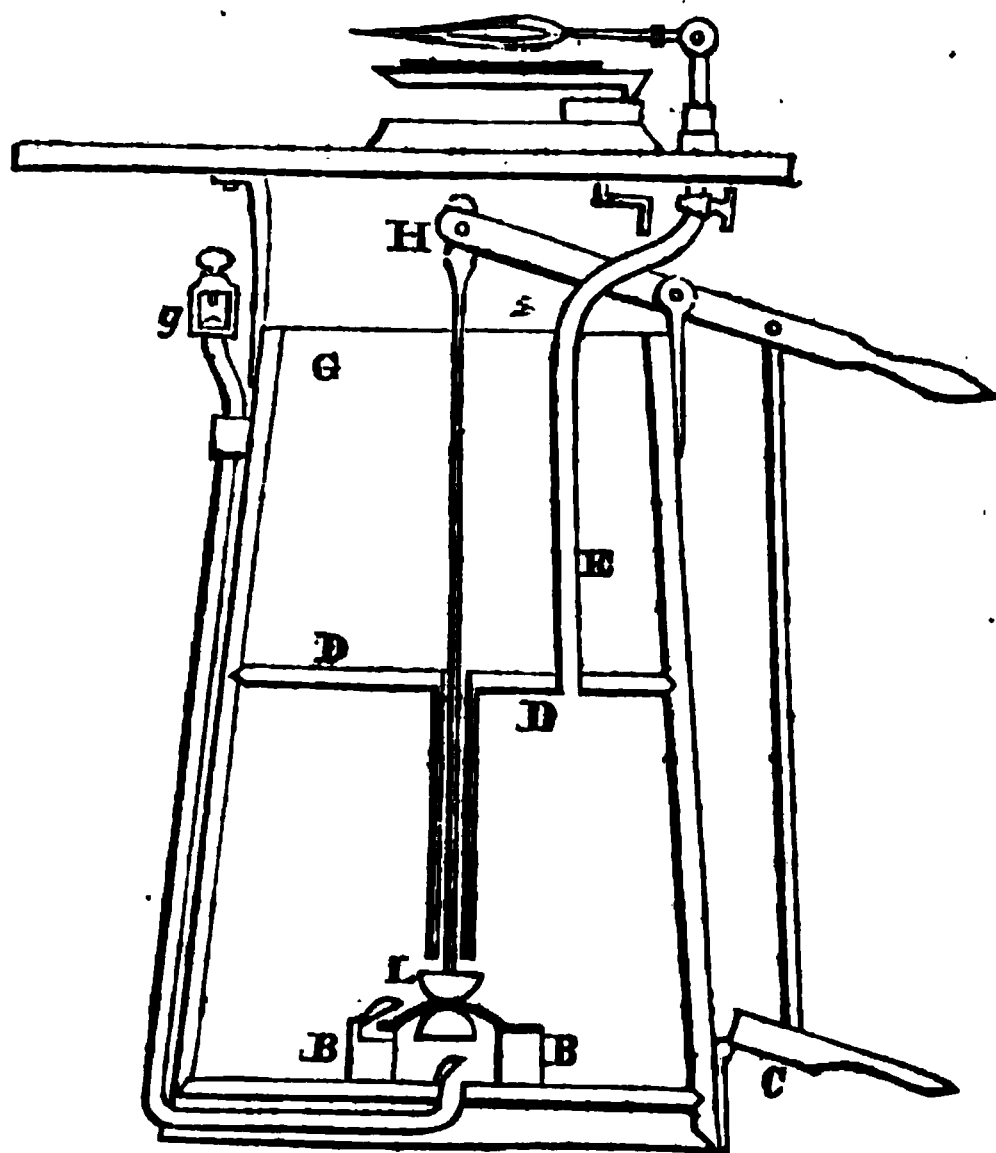
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\* In consequence of this, some artists have abandoned the use of the instrument.

constantly to move the foot, the operator cannot leave his seat ; and in nice operations, the motion of his body is an inconvenience, if not a source of failure. Bellows of this kind cannot be used for supplying combustion with oxygen gas; because, as this air is only to be obtained by a chemical process, it is very desirable to avoid any waste of it ; and, as there is always a portion of air remaining in them, even when the boards are pressed as near to each other as the folding of the leather will permit, any small quantity of oxygen gas which might be drawn into them, would be contaminated.

“Being sensible of the advantage which would result from the invention of a more perfect method of supplying the blowpipe with oxygen gas or atmospheric air, I was induced to search for means of accomplishing this object. The result of my attention to the subject, is the production of a machine, of which there follows an engraving and description.”

The machine, which the following figure represents, does not differ essentially from that alluded to, in the passage above quoted. The construction is, however, more simple and easy.



*Explanation of the Engraving.*—The Hydrostatic Blowpipe, consists of a cask, divided by a horizontal diaphragm, into two apartments, *d d*. From the upper apartment, a pipe of about three inches in diameter, (its axis coincident with that of the cask), descends, until within about six inches of the bottom. On this is fastened by screws, a hollow cylinder of wood *b b*, externally twelve inches, internally eight inches, in diameter. Around the rim of this cylinder a piece of leather is nailed, so as to be air tight. On one side, a small groove is made in the upper surface of the block, so that a

lateral passage may be left under the leather when nailed on each side of the groove. This lateral passage communicates with a hole bored vertically into the wood, by a centre bit ; and a small strip of the leather, being extended so as to cover this hole, is made, with the addition of some disks of metal, to constitute a valve, opening upwards. In the bottom of the cask there is another valve, opening upwards. A piston rod, passing perpendicularly through the pipe, from the handle *h*, is fastened near its lower end, to a hemispherical mass of lead *l*. The portion of the rod beyond this, proceeds through the centre of the leather, which covers the cavity formed by the hollow cylinder ; also through another mass of lead, like the first, which being forced up by a screw and nut, subjects the leather, between it, and the upper leaden hemisphere, to a pressure sufficient to render the juncture air tight. From the partition, an eduction pipe *e* is carried under the table, where it is fastened, by means of a screw, to a cock which carries a blowpipe, so attached, by a small swivel joint, as to be adjusted into any direction which can be necessary. A suction pipe passes from the opening covered by the lower valve, under the bottom of the cask, and rises vertically, close to it, on the outside—terminating in a gallows *g*, for the attachment of any flexible tube which may be necessary.

The apparatus being thus arranged, and the cask supplied with water, until the partition is covered to the depth of about two inches, if the piston be lifted, the leather will be bulged up, and will remove, in some degree, the atmospheric pressure from the cavity beneath it ; consequently the air must enter through the lower valve, to restore the equilibrium. When the piston is depressed, the leather being bulged, in the opposite direction, the cavity beneath it is diminished, and the air, being compressed, forces its way through the lateral valve into the lower apartment of the cask. This apartment being previously full of water, a portion of this fluid is pressed up, through the pipe, into the upper apartment. The same result ensues every time that the stroke is repeated ; so that the lower apartment soon becomes replete with air, which is retained by the cock, until its discharge by the blowpipe is requisite.

The cock being opened, the air confined in the lower apartment, is expelled by the pressure of the water in the upper apartment, which, as the air which had displaced it escapes, descends and re-occupies its former situation. The piston is worked either by the handle, or the treadle, at *C*.

In order to supply the cask with oxygen gas, it is only necessary to attach to the suction pipe (by means of the gallows and screw at *g*), another pipe, duly flexible, and passed under a bell containing the gas in question, over the pneumatic cistern. Or the pipe may communicate with a leather bag, filled with oxygen. I have one, which will hold fifty gallons ; the seams are closed by rivets, agreeably to Pennock & Sellers' plan for mail bags, or fire-hose.

Having used the Hydrostatic Blowpipe for five and twenty years, I am enabled to speak in favour of its conveniency, with the confidence due to this long trial. I am persuaded, that it would be found exceedingly useful, to all artists who employ the blowpipe in solder-

ing, or in blowing, or moulding the tubes of thermometers, barometers, and other processes, to which the enamellers' lamp is applied.

Associated with the large self-regulating reservoir of hydrogen, to be described in the next number of this Journal, it is, with the aid of a jet of atmospheric air, supplied to it in the common blowpipe, competent to fuse platina; and the facility with which the hydrogen flame thus produced, may be made to act in any convenient direction, would render it highly serviceable to silversmiths, copper-smiths, and pewterers. In soft soldering, it is often far more efficacious than a soldering iron. Its peculiar cleanliness is worthy of attention; in this respect it greatly excels the ordinary blowpipe flame. Besides, the limits are peculiarly ample, within which it is susceptible of an instantaneous increase, or diminution, in size or intensity.

I do not believe the heat, produced in this way, to be much more expensive than that produced by a lamp.—*Franklin Journal*.

### SELF-ACTING PIANO-FORTE.

THE Dublin Journal gives a long notice of the mechanism of an ingenious instrument of this kind, stating, that it performs, with extraordinary effect, some of the most classical and difficult music, and that great difficulties have been surmounted by the inventors.

It combines the most rapid and brilliant execution with distinctness and neatness, and they venture to affirm, that there are few players of the piano-forte that can equal it in these qualities. Its harmony is necessarily more full than can be produced by eight fingers, the elements of chords having no other limit than the extent of its scale. The instrument not only plays the usual piano-forte part of a piece, but takes in also the subject of some parts of the score; its *crescendo* and *diminuendo* are graduated with more precision than can be effected by means not mechanical, the time cannot be otherwise than perfectly equable throughout; yet, where pathos is to be expressed, the time can be retarded or accelerated in any degree. In short, this admirable instrument manifests all the capabilities of a living performer, and superadds qualities derivable only from mechanical agency.

The mechanism is simple: it consists of a cylinder, which turns on its axis, and is acted on by a coiled spring, and regulated by a fly-wheel. On the surface of the cylinder a proper arrangement of brass pins is formed, each of which, in passing under a rank of levers, elevates one end of the required lever, and depresses the other. The depressed end pulls down with it a slender rod, which is connected, by a slide, with the tail of a bent lever, on the further end of which is the hammer which strikes the string. The slide can be shifted further from, or nearer to, the axis, on which the hammer lever turns, and thus the stroke of the hammer is made feeble or strong to any required degree. When wound up, the instrument will continue to play for a considerable time; and it is provided with a bench of keys like the ordinary piano-forte, so that a person may accompany the instrument, or play a duet with it, the effect of which is said to be beautiful.—*News of Literature*.

## SQUARING THE CIRCLE.

*To the Editor.*

SIR,

SEEING in your Journal of July 8th, a communication from Ephraim Smooth, disputing the accuracy of Archimedes' method of squaring the circle, I have taken the liberty of replying to the same in defence of the approximation given by that learned mathematician.

E. S. has attempted to prove that a circle of 5 in. diameter is nearer 16 inches in circumference than a circle of 7 inches diameter is to 22 inches in circumference; I deny it: and to prove the same we must have recourse to the nearest approximation at present known (for the exact ratio cannot be determined by any method at present in use), which is, I believe, to multiply the diameter of the circle by 3.1416. Now, Sir,  $3.1416 \times 5 \text{ in} = 15.7080$ , and  $3.1416 \times 7 \text{ inches} = 21.9912$ , which prove that 7 to 22 is within  $\frac{1}{16}$  of an inch from the true result, a variation which would be ridiculous to notice in practice, while 5 to 16 is nearly  $\frac{1}{3}$  of an inch from the truth, a variation altogether inadmissible, when compared with that of Archimedes.

I am, Sir,

July 10th., 1826.

Your's respectfully,

Blackfriars' Road.

X. Y.

P. S. In that part of Ephraim's communication termed Archimedes solution, he has fallen into a serious error in his division: when dividing 329.994 by 22, the quotient should have been 14.999, and not 14.545, as there stated.

**Discoveries & Processes in the Useful Arts.**

ON THE FRENCH PAPIER-MACHEE.—“ This is formed of paper beaten into a pulp with size, and pressed in moulds so as to form snuff boxes and a variety of useful articles. We were much amused (Mr. Gill says) lately, by the information of a friend who had been in Paris, respecting one of the methods by which the materials for this manufacture were obtained. He observed a man, having a large basket slung at his back, and a proper instrument in his hand, quickly strip the walls of the various posting bills with which they were covered, and throw them into his basket. He had the curiosity to follow the man to a considerable distance, and to enquire of him the use he was going to make of them, the man replied, they were for making paper snuff-boxes. And thus both paper and paste were procured for nothing but the trouble and risk of stealing them!—*Technical Repository*, vol. 1. p. 429.

ON THE TRANSPARENCY OF THE AIR PREVIOUS TO RAIN.—At the meeting of the Helvetic Society of natural sciences, at Soleure, July, 1825, a Memoire, by M. de Luc, of Geneva, was read, on the

transparency of the air, as a prognostic of rain, and on the fluids, &c. which diminish this transparency. The author cited many observations, proving that, in general, an extraordinary transparency of the atmosphere, with a pure sky, is followed, in the course of some hours, by an abundant rain. He thinks it may be concluded, that it is not the greater or smaller quantity of aqueous vapour mixed with the atmosphere, which alters, more or less, its transparency; but that the effect is due to some other kind of vapour, to which he has given the name of *dry vapour*. He quotes, as examples of this kind of vapour, that which extended over a great part of Europe, in 1783, and which did not affect the hydrometer; and he ranges in the same class those which frequently confer a misty tint on the air, without giving apparent signs of humidity. These vapours are frequently the precursive signs of a thunder-storm, and the author thinks they have some connexion with the electric fluid.—*Bib. Univ.* xxx. 164.

**IMPROVED JAPANNED PAPER ARTICLES.**—"This improvement consists in cementing sheets of paper upon the moulds of the shape of the articles to be made, and then drying them in stoves; instead of first making tablets thereof, to be afterwards worked into the articles as above described. For many purposes this is, no doubt, superior to the former method; inasmuch as there are none of the blemishes in the article thus made, which were inevitably produced in those put together by means of nails, glue, &c.; and irregular forms can be of course much better produced."—*Gill's Technical Repository*, vol. 1. p. 429.

**TRANSMISSION OF FINELY DIVIDED MATTER BY THE WIND.**—The following instance was communicated to the Editor of the *Ann. de Chim.* (xxx. 430,) by M. Schabelki, an eminent Russian traveller.—"When the vessel was in the latitude of  $23^{\circ}$  N. and long.  $21^{\circ} 20'$  W. of Greenwich, we were witnesses of a very remarkable phenomenon. On the morning of January 23, 1832, being then 275 nautical miles from the coast of Africa, we perceived that all the cords of the vessel were covered with a pulverulent matter, resembling, in its reddish colour, that of ochre. These cords, seen in the microscope, presented long rows of globules, which seemed to touch. It was only those parts which had been exposed to the action of a north-east wind which presented this phenomenon: there was no trace of powder on the opposite face. The powder was very soft to the touch, and coloured the skin red."—*Quarterly Journal*.

**NEW METHOD OF LIGHTING LARGE APARTMENTS.**—M. Locatelli, a mechanician of Venice, distinguished by many important discoveries, has invented a new process for lighting public halls. It is well known that Rumford and others endeavoured in vain to discover the means of dispensing with chandeliers, so inconvenient in theatres and other halls of audience. The new process employed at Venice has completely succeeded, and leaves nothing to be desired. Instead of parabolic mirrors, the light of several lanterns is concentrated on an opening in the middle of the hall, (probably the ceiling); and falls

upon a system of lenses, plano-concave, which fill the opening a foot in diameter, and distribute through the apartment rays, which, falling parallel on the lenses, issue divergingly. From the centre or pit nothing is perceived but the lenses, which resemble a chafing dish of burning coals, illuminating the whole houses, without dazzling or fatiguing the eye. Besides the advantage of being more equal and soft, the light is more intense than that of the chandelier: there is not a spot in the hall where one cannot see to read with the greatest facility.—*Rev. Encyc. Sept. 1825.*

### LIST OF PATENTS, EXPIRED IN JUNE, 1826.

**NEEDLES.**—To John Seambler, of Birmingham, for an improvement in the manufacture of needles.

**CANDLESTICKS AND SNUFFERS.**—To Leger Didot, of London, for improved candlesticks and snuffers.

**ANTI-FRICTION COMPOSITION.**—To H. Hardacre, of London, for a composition to prevent the effects of friction.

**HEMP AND FLAX.**—To James Lee, of Enfield, Middlesex, for an improved method of preparing hemp and flax, and by which other vegetables may be substituted for them.

**BREWING APPARATUS.**—To James Needham, of Islington, for improvements in his patent brewing apparatus.

**WEAVING.**—To John Webb, of Middlesex, for an improved method of weaving.

**LAMPS.**—To Benjamin Black, of London, for an improvement in the construction of carriage lamps.

**SHIP-BREAKING.**—To William Averill, of London, for his machinery for extracting corroded iron from ships' bottoms.

**COFFEE-ROASTING.**—To Anthony Shick, of London, for an improved method of roasting coffee.

### TO CORRESPONDENTS.

**HISTORY OF THE STEAM ENGINE.**—We have to express our regret at being unable to supply the continuance of this History with that regularity we anticipated; but the new engine, which is the invention of Mr. Galloway, occupying much more of his time than he expected, has caused a delay which is unavoidable: that cause is now, we are glad to say, removed, and he has promised to supply us with greater dispatch and punctuality for the future.

A SEAMAN has been received, we will seek for the information he requires.

A CONSTANT READER has our thanks for his advice; whether the assertion of E. S. be correct or otherwise, it appears to be deserving of investigation, and we are not disposed to say it is positively wrong, without making a direct experiment to prove the fact: we were perfectly aware of the rule given, but not of the evidence of its being a true one.

The article on Stenography sent to us by ACADEMICUS, is not suited to our publication. The characters possess but little originality, and the expense of wood cuts to represent them would be too heavy to be borne by the proprietors of this work.

We have received several letters of enquiry, which we shall arrange and insert in substance in our next.

E. R. and H. L. are intended for early insertion.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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WRIGHT'S  
MACHINERY FOR WASHING AND BLEACHING.

## **S. W. WRIGHT'S PATENT MACHINERY AND PROCESS FOR WASHING AND BLEACHING.**

**T**his invention appears to us to be one of the greatest improvements of the present day in the arts to which it relates. The several processes of washing, cleansing, bleaching, and drying, are almost wholly affected by the simple agency of high pressure steam, without the goods being submitted to *rubbing*, so injurious to most fabrics, but especially to those of fine texture. The steam is made not only to act a chemical part in the several operations, but by its expansive force to perform a mechanical one also; to fill, to discharge, and to refill at pleasure, a series of vessels with the fluids required in the successive processes, and all these are effected without any other manual aid but the occasional turning of a few stop-cocks. The inventor of this apparatus is Mr. Samuel Wellman Wright, of Princes Street, Lambeth, whose extraordinary Pin-Making Machine recently patented, has excited so much astonishment and admiration.

As the specification of this invention is unattended with the nonsensical tautology common to such documents, and is both explicit and concise, we shall in our account avail ourselves principally of a copy of it now before us. The preceding diagram must be considered as illustrative of only one eligible mode of performing the operations, as the form and disposition of the vessels, and other parts of the apparatus, may be varied according to circumstances. By this arrangement, the goods to be cleansed or bleached, are first packed closely into a conical vessel, through which steam is caused to pass for a while; next the steam is made to force an alkaline solution through the goods, to remove the impurities or colouring matter (which operation is repeated as often as may be judged expedient); then hot water is impelled through the goods, to remove all the alkaline matter; ultimately, steam of a high pressure is forced through to expel the water, by which the goods are left nearly in a dry state, and perfectly clean. A subsequent process, that of introducing blasts of cold air through the goods, may also be employed, by which the whiteness of the fabrics will be further improved.

A, is a copper vessel, formed as the frustum of a cone, at the lower part of which is a perforated false bottom or grating, and below this the real bottom, from whence a pipe descends. The cotton, linen, or other articles to be operated upon, having been previously soaked in water and rubbed over with soap, are to be closely packed in this vessel, the lid of which is then to be screwed down, and rendered steam tight at the junction. In the diagram, this conical vessel is shewn, surrounded by a jacket, to prevent the radiation of the heat, but this addition the patentee does not consider to be absolutely necessary. B is a vessel (which is also of copper, as well as the other vessels and tubes represented), containing soap and water, or the usual alkaline solutions of pearl-ash, soda, &c.; C is a pipe leading from a steam boiler, through which is introduced steam, that has been raised to a pressure of 50lbs. upon the inch, which is at first to be gradually admitted into the apparatus, by par-

finally opening the stop-cock *a*, when it passes into the vessel A, where it is allowed to act upon the goods therein deposited for half an hour; after which the cock *a* may be completely opened, and the full force of the steam be allowed to operate, first opening the cocks *b*, *c*, *d*, *e*, when the steam will pass up the pipe D into the vessel B, containing the alkaline solution. The pressure of the steam upon the surface of the liquid in this vessel, will now cause it to descend through the pipe E into the vessel A, and herein the steam continuing to press, will force the alkaline liquid through the goods, saturating every part, and carrying dirt and other impurities to the bottom, the liquid passing off through the pipe F, into the receiver G underneath.

The pressure of steam is next employed to refill the vessel B with the discharged alkaline liquor; for this purpose, the cocks *b*, *c*, *d*, *e*, are to be closed, and the cocks *f* and *g* to be opened; the steam will now pass down the pipe H, and operate with its full pressure upon G, thereby forcing the liquid up the pipe I I again into B; from whence it is forced again through the goods in the vessel A, repeating the operation as often as it may be found necessary, in order to perfectly cleanse them; the number of times it will require will depend upon their degree of foulness, &c. which can only be determined by experience: for the ordinary washing of body linen, twenty times have been found sufficient.

Having now removed all the dirt and other impurities from the articles operated upon, the next process is that of rinsing, which is effected by closing the cocks *b*, *c*, *d*, *e*, *f*, *g*, and opening those at *i*, *k*, and *h*, when the steam from C passes up the pipe K into the vessel L, which is filled with clean hot water; the full pressure of the steam being now transferred to the surface of the hot water forces it through the pipe M, and through the goods in the conical vessel A, carrying away the alkaline and other impurities through the pipe N into the vessel O. The hot liquor in O is now to be returned into L, by *i* *k* *h*, and opening those at *l* and *m*, when the steam passes down the pipe P, and forces the liquor contained in O up the pipe Q Q again into L for the renewal of the operation, this part of the process being also repeated as often as may be deemed desirable, which will depend upon the condition of the goods.

The washing and rinsing having been performed, drying forms the next part of the process, which is effected by closing all the cocks except those at *a* *d* *e*, and allowing steam at a reduced pressure to pass direct from *c* into the vessel A again, by which all the water is driven out from the goods, leaving them in nearly a dry state, the steam passing off through the pipe F, and escaping at R. In this part of the process it is necessary to observe that steam should not be employed at a greater pressure than 20lbs. to the inch, and that its action should not be prolonged beyond the time required for driving off the water.

For the bleaching of piece goods, in lieu of the circular-sided vessel A, the patentee recommends one with straight sides, with its area diminishing downwards: in this vessel the goods having been carefully folded, are to be packed closely together, and, in addition

to the steaming and washing by means of alkaline solutions, currents of cold air, produced by a blowing machine, are to be admitted through the pipe S, which it is said greatly assists in whitening the fabric.

### LESLIE'S APPARATUS FOR MEASURING THE SPECIFIC GRAVITY OF FLUIDS.

THE instrument consists of a glass tube,  $a c$ , about 3 feet long, and open at both ends. The wide part,  $a b$ , is about four tenths of an inch in diameter; the part  $b c$ , about two-tenths. The two parts communicate at  $b$  by an extremely fine slit, which suffers air to pass, but retains sand or powder. The mouth at  $a$ , is ground smooth, and can be shut so as to be air-tight, by a small glass plate  $f$ . The substance whose specific gravity we wish to find, suppose it to be sand, is put into the wide part of the tube  $a b$ , which may either be filled or not. The tube being then held in a vertical position, has the narrow part immersed into mercury contained in an open vessel  $x$ , till the metal rises within to the gorge  $b$ . The lid is then fitted on air-tight at  $a$ . In this state it is evident there is no air in the tube, except that mixed with the sand in the cavity  $a b$ . Suppose the barometer at the time to stand at 30 inches, and that the tube is lifted perpendicularly upwards, till the mercury stands in the inside of  $b c$ , at a point  $e$ , 15 inches (or one half of 30) above its surface, in the open vessel; it is evident, then, that the air in the inside of the tube is subjected to a pressure of exactly half an atmosphere; and, of course, it dilates and fills precisely twice the space it originally occupied. It follows, too, that since the air is dilated to twice its bulk, the cavity  $a b$  contains just half what it did at first; and the cavity  $b c$  now containing the other half, the quantity of air in each of these parts of the tube is equal. In other words, the quantity of air in  $b c$  is exactly equal to what is mixed with the sand in  $a b$ , and occupies precisely the same space which the *whole* occupied *before* its dilatation.



Let us now suppose the sand to be taken out, and the same experiment repeated, but with this difference, that the cavity  $a b$  is filled with air only. It is obvious that the quantity being greater, it will, when dilated to double the bulk, under a pressure of 15 inches, occupy a larger space, and the mercury will rise, let us suppose, only to  $d$ . But the attenuated air in the narrow tube always occupies exactly the space which the whole occupied at ordinary atmospheric pressure; and this space is, therefore, in the one case the cavity  $b c$ , and in the other  $b d$ . Hence it follows, that the cavity  $c d$ , which is the difference between these, is equal to the bulk of the solid matter in the sand. Now by marking the number of grains of water held by the narrow tube  $b c$  on a graduated scale attached to it, we can find

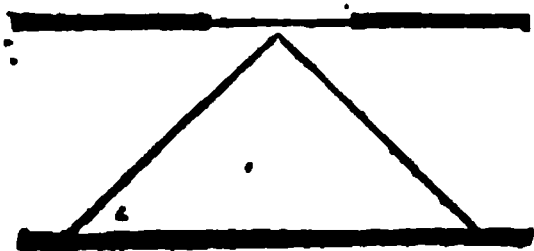
at once what is the weight of a quantity of water equal in bulk to the solid matter in the sand, and by comparing this with the weight of the sand, we have its true specific gravity.

Aware that some solid bodies, such as charcoal, hold much condensed air in their pores, and that, probably, they retain part of this even when reduced to powder, Professor Leslie obviates the chances of error arising from this source; by comparing the dilatation which takes place under different degrees of pressure, under 10 in., and 20 for instance, or 7½ and 15.

Charcoal, from its porosity, is so light that its specific gravity, as assigned in books, is generally under 0.5, less than half the weight of water, or one-seventh the weight of diamond: taken in powder by the above instrument it exceeds that of diamond, is one half greater than that of whinstone, and is, of course, *more than seven times heavier than has usually been supposed*. Mahogany is generally estimated at 1.36, but mahogany saw-dust proves by the instrument to be 1.68; wheat flour is 1.56; pounded sugar 1.83; and common salt 2.15; the last agrees very accurately with the common estimate. Writing paper, rolled hard by the hand, had a specific gravity of 1.78, the solid matter present being less than one third of the space it apparently filled. One of the most remarkable results was with an apparently very light specimen of volcanic ashes, which was found to have a specific gravity of 4.4. These results are, however, given as approximations merely by the first instrument constructed.—*Scotsman*.

### RITCHIE'S NEW PHOTOMETER.

MR. RITCHIE, of Nain, has constructed a very simple Photometer, on the principle of Bougier. It consists of a rectangular box, about an inch and a half, or two inches square, open at both ends, and blackened within for the purpose of absorbing irregular light. Two rectangular pieces of plain mirror are placed within the box, at right angles with each other, and at an angle of 45° with the sides of the box. A rectangular opening is cut in the upper side or lid of the box, about an inch long, and an eighth broad, and passing over the line formed by the intersection of the two mirrors, is half over the one, and half over the other; the aperture is to be covered with a slip of fine tissue or oiled paper. When used it is to be placed in



the same straight line, between the two flames to be compared, they being distant six or eight feet from each other, and is to be moved until the disc of paper is equally illuminated by the two flames. The illuminating powers of the two flames will then be directly as the

squares of their distances from the middle of the Photometer. In viewing the illuminated disc, it is as well to look at it through a prismatic box about eight inches long, blackened within, to absorb strong light.

Sometimes, instead of using mirrors and the paper screen, the inclined planes are covered with white paper, and looked at directly through the aperture. However the instrument be used a mean of several observations should be taken, the instrument being turned round each time.

When the lights are of different colours, the plan Mr. Ritchie recommends, is to cover the rectangular opening in the instrument with a piece of fine white paper, printed distinctly with a small type; the paper is to be brushed over with oil, and then the instrument being placed between the lights, they are to be moved till the printing can be read continuously along the paper with equal ease on the one side as the other. In the second form the printed paper is to be pasted on the mirrors, or the inclined surfaces against which they lie, and is then to be read through the opening. It is advantageous to enlarge the openings in these applications of printed paper.—*Quarterly Journal of Science.*

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## ESTABLISHMENT

FOR THE EXHIBITION AND SALE OF NEW INVENTIONS.

*To the Editor.*

SIR,

It is too frequently a matter of national reproach that genius rarely reaps the benefit of its own production however meritorious; competition and envy, ever founded on selfishness and ignorance, engender a mass of evils injurious to the interests and happiness of the most valuable members of society. It would, therefore, be desirable if a portion of those evils could be obviated by some simple means that would do good to many, and harm to none. The just rewards which are due to the authors employed in objects of vast utility, convenience, and domestic comfort, how often do we see swallowed or pirated by those who never entered into the spirit of the project, nor toiled in their execution.

A plan is now in progress which it is presumed will remedy some of those evils. It embraces certain means for giving publicity to new inventions and discoveries, with appropriate show rooms for their sale.

The advantages of this establishment must be great in its forming an exhibition of select specimens of art or mechanism, which might otherwise be lost to the world, or neglected in obscurity.

An equitable rent and commission are chargeable on each article.

Suitable premises, in one of the best situations in London, are about being treated for. So soon as the arrangements are complete, intimation will be given to the public.

Stations for the sale of several patent articles of great merit are already bespoke.

Sir, Your's, &c.

J. MACSHEIMIS.

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## LETTERS OF ENQUIRY.

**ON BURNING OF CLAY.**—M. P. is in search of the most improved method of burning clay for manure, or the foundation of roads: also where he can obtain the best information respecting the clay puzzolani."

**ON THE AREAS OF CIRCLES,** *from a Birmingham Founder, who writes us as follows:—*" Having frequent occasion to calculate the contents of circles and hollow cylinders, I should find it a great convenience and satisfaction to be able to refer to tables wherein the results of such calculations are given. I presume this has been already done, and shall be greatly obliged by the information where the most correct tables can be procured."

*[We have lately seen, in the hands of a young Engineer, a card for the pocket book, containing a printed table of the areas of circles from one-sixteenth of an inch in diameter up to those of very large dimensions. We do not know where they are to be obtained, but suppose that application to Taylor's Library, 52, High Holborn, or G. Hebert's, 88, Cheapside, will at least lead to their procurement.]*

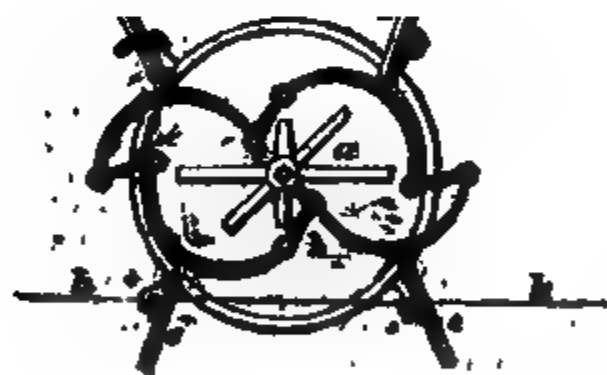
**ON PASTING ON CANVAS.**—A correspondent, G, is desirous to be informed " of the best method of pasting large maps upon cloth so as to adhere to every part thereof, and be free from air-cockles."

*[We believe that a considerable degree of skill, acquired only by practice, is necessary to execute this operation well, on large surfaces; so much so, that it forms a distinct Business in London. (Mr. Ruff, of Hind Court, Fleet Street, is in this line.) The work is executed to perfection, and the charges extremely moderate.]*

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**PATENT FLOORING MACHINE.**—" A machine has recently been invented, and patents obtained for it, which at once performs all the various operations for converting rough-sawn boards into completely-finished flooring. It reduces the boards to an uniform breadth, planes it; cuts the groove in the one edge, and works the feather or tongue on the other; it also removes the superfluous thickness from a sufficient portion of that part of the board which is destined to become the underside of the floor, and even takes off a minute portion of the arris, that the joints may enter with more facility in laying it down; the whole being executed in a superior manner, and, as may readily be imagined, with much more accuracy than if performed by the most skilful workman."—*Literary Chronicle.*

**DYEING.**—It has been found hitherto impracticable, it is said, in dyeing certain colours to obtain at will a regular gradation of shades. In a paper recently read at the Academy of Sciences, at Paris, by M. Chevreul, he states that he has triumphed over this difficulty by a happy application of the principles of chemistry. He presented the Academy with a specimen of his blue dyes, exhibiting all the shades of that colour, from the lightest to the deepest tint. A comparative specimen of the results obtained by the old process, sufficiently proved the benefit which the useful arts will derive from this discovery. M. Chevreul is making experiments on other colours.



### HILL'S PATENT PADDLE WHEELS.

THE patentee of this invention is Lieutenant W. H. Hill, of the Royal Artillery, Woolwich: the object of it is to give a more true, and consequently a more efficient direction to the propelling force of the paddle wheels to steam vessels. The levers which connect the paddles to the wheel are so constructed and arranged, as to produce an alternating motion upon each other as they successively pass through the water in their rotation; that is to say, the resistance

against the foremost immersed paddle, causes the next in succession to assume that peculiar inclination or position in the water, which is best adapted for the application of the propelling force derived from the engine: and this movement is productive of a corresponding good effect; for the resistance of the water now acting forcibly against the second paddle, keeps the foremost paddle nearly in a vertical position until it is lifted out of the water so as to prevent the misdirection of its force. These points will, however, be better understood and appreciated by the reader, contemplating for awhile the preceding illustrative diagrams.

*Fig. 1* exhibits a side view of the levers and paddles fixed to the wheel; the spokes or arms, *a a*, of this wheel are not (in the diagram) drawn through to the periphery *b b*, to prevent confusion, and the supposition of the levers being connected with them. *c c c c* are four bent levers, one of which is shown separately by *Fig. 3*. *e e e e* show the edges of the paddle boards, which are bolted to the straight arms of the levers; these are connected by axles to four short arms *f f f f*, which radiate from the periphery of the wheel; each end of the curved part of the levers are attached to the next lever in the series, by an intermediate short rod *g g g g*; the connection of these short rods with the levers being effected by pivot joints, the resistance of the water to the revolution of the wheel causes the paddles to assume such an angle that they give an *elliptical* stroke instead of a circular one, as usual; while they enter and quit the water with much greater facility from the same cause, thus preventing the wasteful application of the power of the engine.

The diagram, *Fig. 2*, is intended to exhibit the peculiar action just mentioned, of the levers and paddle wheels, which they successively undergo in passing through the water. The surface of the water, in figures 1 and 2, is represented by a line *h h*.

In the specification the patentee gives simple and clear geometrical instructions for the construction of his ingenious apparatus, by which their true and regular action may be insured: the lines there drawn also serve to show the curves described by the several levers, the range and limit of their action: affording likewise ample evidence of the talents and ingenuity of their contriver. Those of our readers who wish for more information relative to this invention we refer to No. 7 of *The Repertory of Patent Inventions*, where the specification is given entire, together with the observations of the patentee, in further elucidation of the subject.

## History of the Steam Engine.

### CHAPTER III. *concluded.*

“ This, my lord, is the mean adopted for giving motion to the external mechanism of the engine, by connecting it with the piston, which is here close shut up in the internal part of the cylinder; and

as I have already observed, the cylinder is placed with its bottom upwards, compared with Newcomen's, this connection between the internal and external motion must of necessity be communicated through the bottom, which now becomes the top of the cylinder. As the entire effect of the engine depends on ascertaining a method of doing this completely, and seeming to form a most material part of the whole invention, I will be more particular in describing it to your lordship, and begin by stating how this was performed by Newcomen.

“ In all Newcomen's engines, where the top of the cylinder was entirely open, the piston was connected with the working beam by a single or double iron chain; in most cases double at the upper end next the beam, and the lower end commonly formed a junction with the piston by an intermediate strong bar of iron, in some cases a strong rod of wood shod with iron. By this means the force the piston received from the pressure of the atmosphere was communicated to the beam above, and that in as rough a manner as the workmen pleased to make it; the smoothness and truth of workmanship being unnecessary in this case.

“ But, only behold, my lord, the difference required in Watt's engines in this one particular!

“ The above two motions are to be connected by means of a rod or other contrivances, (for a chain, &c. will not answer here), which must not only pass through an aperture in the cap or top of the cylinder, steam and air-tight, but this aperture is required to be kept thus close during every stroke the engine makes.

“ This cannot fail of striking your lordship in a serious point of view; and, from what has been said, it must involve a conclusion in your mind, that this part is one grand essential, if not the most so, of any in the machine; as the smallest imperfection here will admit the air when the vacuum is made, and thereby completely stop the engine.

“ Having thus prepared your lordship, I will now describe that which Mr. Watt should have done, i. e. the manner in which the internal piston is connected with the working beam without.

“ This is by an iron rod of a sufficient diameter, turned and otherwise worked so as to be perfectly smooth and parallel from one end to the other, and of a length sufficient to allow the full stroke of the piston within; and I think it necessary to remark, that if in this rod there should be the smallest rag or flaw, it is totally unfit for its purpose; for reasons that will appear hereafter. And I am certain, from my own knowledge, that Mr. Watt in his first outset on this business, found more difficulty in procuring these rods in all respects perfect, than he would have done in constructing all the parts of Newcomen's engine; although this article, like the rest, is not mentioned in his specification.

“ Fifthly,—I shall proceed to explain to your lordship a circumstance in this part of the engine, in my opinion, as material and of equal consequence with the preceding, or any other article in the machine. This is the method of rendering the aperture, through

which the piston rod passes; constantly air and steam tight; notwithstanding the said rod in many engines slides through this aperture no less than three hundred and twenty feet per minute during the time they work.

“ This junction or aperture is a very ingenious contrivance, and is called a stuffing box; it is a part formed in the centre of the cap or top of the cylinder; and is a kind of cylindrical box, of about six or eight inches deep, made of iron. The upper part of this box is considerably wider than the diameter of the piston rod above-mentioned; and the bottom or lower part next the inside of the cylinder is made exactly to fit the said rod. From this part, for a small distance upwards, the box is turned in a conical form, so as to make a chamber exactly in the shape of a snuff mull; at the top of this conical part is turned a rebate or seat, into which is fitted a brass or iron ring, the extreme circle of which exactly fits the cylindrical part above the conical part described. This conical chamber is then filled with hemp or junk, so as to surround the piston rod on all sides; and being secured down by the brass or iron ring above-mentioned, causes the rod to slide steam and air-tight. But the quantity of rub which is constantly on this part, and the nice perfection required, soon discovered the want of some farther help; and something similar to the means just treated on for keeping the piston tight, suggested itself at an early period of Mr. Watt's experiments, which is effected as follows.—

“ In the cylindrical part of the box is turned another rebate, about an inch more or less above the ring which secures the lower packing; and into this rebate is also fitted a ring as before, which causes a space between it and the lower ring. Then above the upper ring is turned another cylindrical part like the former, having, of necessity, a greater diameter. This conical chamber is likewise packed with hemp, junk, &c. and this packing also fastened down by means of a ring, rather more in a plug form, and so contrived as to admit of being screwed down at pleasure, for the purpose of compressing the packing as worn away by the friction of the rod. The stuffing box completed, a small tube is inserted by one of its ends at the side of the said box, so as to communicate with the open space comprehended between the rings. The contrary end of this tube is joined to the steam pipe or boiler, where the steam is always active; and by this means a constant supply of steam is thrown into the space aforesaid, which steam preserves the rod air-tight, being kept as strong or stronger than the pressure of the outward air. Thus the steam here does the office of water, &c. on the piston of the engine when the packing becomes rather insufficient.

“ I think, my lord, I need not say more on this point, to prove the necessity of a full and clear specification; and the practicability of giving one had there been a willing mind.

“ Sixthly—I observe the lower end of the steam cylinder to be also closed; and that the steam has alternate communication with the cylinder above and below the piston, just contrary to that of Newcomen.

“ To detail the true nature of all this would be tiresome to your lordship; and as Mr. Watt has not done it, I shall decline doing it for him; though certainly well able.

“ Seventhly—I come to what is called condensers. On this part of the subject I am almost puzzled what to say. From the specification I can say nothing; from the engines, they have been made in all forms; and that by changing about and mixing the knowledge of every person in his way for twenty years at least, Mr. Watt has been taught what is the real fact, and what they confessed to be so on the late trial, namely, that no condensers are necessary but that which Newcomen calls the eduction pipe, and in which the condensation is performed by a jet of cold water, answers the same purpose equally well.

“ Then it appears, my lord, that twenty years exercise of the superior abilities of Mr. Watt, with the help of all he could gain from the knowledge and practice of other men, and the assistance he received through the space of six years more from Professor Robinson, Dr. Roebuck, Mr. Cummings, and, no doubt, many others, eminent in the theory and practice of the arts, was only to prove what I said before they acknowledged it, that all condensers do more harm than good; and that when men of better judgement have constructed engines totally without condensers, as good or better than their own, they have just candour enough to admit the fact, and pride and avarice enough to claim them as their invention.

“ There is, as your lordship has been abundantly informed, a valve placed in the passage allotted to conduct the steam, water, &c. from the cylinder to the condenser, which alternately opens and shuts this communication. I have to remark that, when the steam regulator, as in Newcomen's engine, opens to the cylinder, and at the same time causes the first jet of steam to discharge the water and air as above described; this valve in Mr. Watt's engine is then open to the condenser; and was there nothing else, the steam would, as well as act on the piston, fly to the condenser, and being there destroyed at that end, if I may so say, would not move the piston at all, it was, therefore, necessary for Mr. Watt to introduce another valve, which he has done. But certain reasons, best known to himself, which the writer of this will not pretend to suggest, induced him to omit giving your lordship and the court an account of it; though, as I have already noted, on the other valve his counsel were very profuse.

“ This cunning valve, my lord, is like the injection water smuggled into another part of the engine, and serves, as in the preceding case, to open and shut a communication. It happens, however, not to be the communication between the cylinder and the condenser, but, what is of much greater consequence, it opens and shuts the passage between the boiler and the condenser. I have materially to remark to your lordship respecting this valve, that it must be and is always shut during the time the steam regulator is open. How, then, is it possible, my lord, that this condenser can be cleansed as in Newcomen's, provided even the former objections did not exist? Thus, having aimed at as much perspicuity as possible, I hope, and am

even confident, your lordship, although no engineer, will perfectly understand what I have advanced; and be convinced of the necessity and practicability of giving a full and explicit description of this point also. I shall now proceed as proposed, with some detail on the nature, proportion, and situation of Mr. Wood's very ingenious and valuable application of a pump or pumps for the extraction of the water and uncondensed vapour; which would otherwise much impede the working of the engine, as Mr. Watt, for a wonder, has had the candour to declare in his specification.

"I will here intreat your lordship's patience while I make a solemn protestation. I declare, and I challenge every scientific man to disprove it, that all the improvements which have yet fallen within my observation on Steam Engines, do wholly depend on the application of Mr. Wood's invention, viz. a pump; or, I will at least say, in a proportion of fifty to one compared with the other additions made by Mr. Watt, with all his retinue of doctors, professors, philosophers, mathematicians, and mechanics.

"Now for this pump, the ingenious invention of Mr. Wood. I repeat his name, as your lordship, having heard less about this pump on the present than on former occasions, might be at a loss to judge the cause of this declension, and on this account I shall be more plain on the subject. Much pains were taken on this trial to convince the court that proportion, lateral and altitudinal situation, did not at all or not essentially signify; I will therefore confine what I have to say more directly to these points; with a small digression only to consider, as in the case of Mr. Gitty, some remarks from the eminent and ingenious Mr. Cummings, respecting this important article.

"My experience, my lord, obliges me to allow, that when a pump is introduced, or added to one of Newcomen's engines where there is no condenser, a trifling latitude in the size, over and above the real *marimum*, is of little moment, and may be exercised without much detriment to the engine; but I find the closer we adhere to the smallest that is sufficient, the less the power of the engine is impeded by giving it motion.

"As the actual proportion the pump ought to have been to the cylinder, must be the result of duly considering the engine both in a perfect and less perfect air-tight state, I will leave every engineer to study for himself as Mr. Watt has done; and hasten to give my reasons why pumps, constructed without regard to proportions, &c. as above mentioned, will not answer in engines made with condensers.

"Suppose, my lord, I constructed an engine on the plan of Mr. Watt, with a steam cylinder exactly equal to one of Newcomen, to which I have annexed a pump of proper size; I should be very naturally led to make this second one from the same patterns; experience having shown me the propriety of its dimensions, and to save also the expense of new patterns, tools, &c. This done, I come to determine the size of my condenser. If I am at a loss in this I go to Mr. Watt's specification; there I find not a word to help me. I then post off, perhaps, from Manchester to Cornwall, to see a condenser; when I come there I traverse the whole county in the cha-

racter of a spy, and none will even permit me to enter their works, (and should I intrude without a licence, I should soon get myself expelled,) much less stop the engine and disorganise the whole, to give me the knowledge I am seeking. My own reason, by this time more awake, makes this inference: that, provided I did succeed in meeting with a person friendly enough to suffer my scrutiny, I must of course pay the loss accruing from such an enterprise,—and, for an idea of this, I will refer your lordship to the observations already made on stopping engines. Just as wise, therefore, as when I started, I post back to Manchester, resolved to make a condenser of some sort. I begin by reflecting, not on the thing, for I know not what it is, but on its reputation; and if I chanced to recollect the high encomiums it received in the Courts of Westminster and London, I should be led to conclude, that was my engine all condenser, I could not fail of being on the right side of the question. Thus I determine my condenser shall be (what I have seen some made by Mr. Watt, at the Soho, Birmingham,) as large, or considerably larger than the steam cylinder of the engine for which it is intended. This would be at least twelve or twenty times the dimensions of my pump, but say twelve times for the sake of data; and suppose the engine completed and ready for action: the consequence of this I will endeavour to make plain to your lordship. When the engine has been emptied of her air, and also the condenser, by what Mr. Watt's engineers call blowing through; the steam valve is opened and the piston makes a stroke; then the discharge is made from the cylinder to the condenser by opening another valve. Now let it be supposed that the uncondensable air or vapour which then fills the condenser, and is to be drawn out by a pump unequal in expansive force to one-twelfth part (and it is seldom less) of the steam's pressure on the piston. The air pump, which I have already said is only one-twelfth part of the contents of this condenser, makes one stroke also; but by this the expansive force of the vapour can only be reduced one-twelfth part, for it must take twelve strokes of this pump to reduce the vapour in the condenser to its least density; and, consequently, there will remain a resistance to the second stroke equal to  $\frac{11}{12}$  of the force of the vapour mentioned; and to the next stroke  $\frac{10}{12}$  and every continued stroke in this proportion; so that in about thirteen strokes this air and vapour would inevitably become as strong in the condenser as the steam; and, by thus restoring the equilibrium, of necessity stop the engine, although she had nothing but her own materials to carry, and those void of friction."

Making due allowance for the prejudiced feeling with which these remarks of Bramah's were written, arising from the successful rivalry of Watt; our readers will find much interesting information contained in them. It shows clearly the insufficiency and obscurity of the specification in question.

Yet Mr. Watt was a truly wonderful man. His ideas were great, and many of his discoveries were successful beyond all previous conjecture. He has done more for art and commerce than any single individual ever known: but, whilst we admit all this, we must also

say few men would have put their names to many of the inventions which appear under his. All men have, at times, made discoveries, which they imagine to be excellent, but which prove otherwise: but few have put upon record so many absurd and impracticable schemes. What are we to say to his many rotative engines, to his six contrivances for regulating the motion of his engines, to his method of working engines by the alternate expansion and contraction of the steam? That they were most of them impracticable, and some of them the most contemptible schemes that ever entered the brain of a projector. His mind seems to have been capable of any thing; but he was too inactive both in body and mind to set about satisfying himself of the true value of his inventions. Many years elapsed before he submitted his great scheme to the test of experiment; and, when the means were afforded, three years passed over before the experiment was completed. Long intervals elapsed between his visits to Soho, even when many of his most important experiments were in progress. We cannot think with Playfair that "he never went either before or beyond the direct inference which could be drawn from an experiment; or that so great was his sagacity, that few bearings of that experiment were omitted or overlooked." We have shown on the contrary that not one half of his schemes answered, and that he, like all men, was liable to misconception and error.

[To be continued.]

### Discoveries & Processes in the Useful Arts.

**ROCKETS.**—M. Vaillant, an inhabitant of Boulogne, the inventor of the winged rockets which made so great a noise in Paris, in 1823, has just discovered a new mode of discharging rockets without wings or sticks. In a trial recently made, notwithstanding there was a very strong westerly wind, his rockets mounted much higher than the common ones, without deviating in the slightest degree from the right line. This invention promises to obviate the accidents frequently occasioned by the rockets with sticks, and the inconvenience and liability to derangement of the winged rockets. M. Vaillant is on the point of repairing to Paris, there to repeat his experiments on a larger scale.—*French Journal*.

**IRON WIRE SUSPENSION BRIDGE OVER THE RHONE.**—A bridge of this kind has been constructed by M. Sequin across the Rhone, between Tournon and Tain. A mass of masonry has been raised in the middle of the river upon piles, and a strong abutment of stone constructed on each bank. These erections divide the width of the river into two equal parts of 100 metres each (328.1 ft.) and upon each of them has been raised a thick support, of a height calculated so as to bear the two ends of the chains on which the platform of the bridge rests, suspended by six bundles of iron wire on each side, arranged one above the other in vertical planes, at a distance equal to the width of

the bridge. The wires are a line in diameter, and each bundle or cable contains 100 wires; from each cable descends vertical bundles of 60 wires each, which at every metre support the pieces of wood, in which is placed the platform of the bridge.

The platform is sufficiently wide in the middle to allow the free passage of a carriage of the largest size, and to leave on each side a foot path of 30 inches wide. At the distance of 20 feet from the central pile, the road gradually widens, so that, when over the masonry, it is competent to contain two carriages at once, and thus facility is afforded for the passing of carriages on the bridge, without permitting more than one at a time on the suspended part.

The end of each cable, after having passed over the supports at the extremities of the bridge, descends along the masonry, and is made fast to strong imbedded cast-iron plates. The cables which proceed from Tournon rise before the town, pass over the support, proceed to the middle support, and having crossed it, are made fast to it on the Tain side; and those cables which pass from Tain are in like manner made fast to the central pile on the Tournon side.—*Biblio. Univer.*

**SPONTANEOUS INFLAMMATION OF CHLORINE AND OLEFIANT GAS.**  
—Dr. Silliman has had occasion to observe the spontaneous inflammation of a mixture of chlorine and olefiant gas, and warns chemists against its recurrence unawares. It took place apparently, in consequence of mingling the gases in such a way that the olefiant gas occupied the upper part of the receiver, and the chlorine the lower; the two being in contact, but generally very distinct from each other. After remaining in this state a few minutes a bright flash pervaded the bell-glass, which held five or six quarts. It was raised out of the water with a slight report, a dense deposit of charcoal lined the vessel, and covered the water, and the chlorine disappeared.—*American Journal of Science.*

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#### TO CORRESPONDENTS.

The list of new and expired Patents in our next number.

Mr. Peel's Letter being erroneously directed has been the cause of the delay in its appearance.

The plaint of a PIANO-FORTE MAKER has been received, but is too discordant for insertion.

The "few lines" sent us by COMPASSES go round about the point; his arguments would be better illustrated by the parallel rule.

The information sought by R. S. he will meet with in Rees's Cyclopaedia.

The "Apology of A MUSULMAN" cannot have been intended for our Work; it therefore remains at our Publishers' for the writer: the Evangelical Magazine is, perhaps, the best vehicle for his opinions.

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# REGISTER

OF

## THE ARTS AND SCIENCES

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CENTRE FOR AN ELLIPTICAL ARCH OF 136 ft. SPAN,—By WILLIAM MOSELY, Esq.

## CENTRE FOR AN ELLIPTICAL ARCH OF 136 ft. SPAN,

By WILLIAM MOSELY, Esq. Architect,

63, *Lincoln's Inn Fields.*

THE interior face of the arch is the segment of an ellipse whose conjugate axis is 140 ft. 3 in., its semi-transverse axis is 48 ft. 6 in. The span of the segment is 138 ft. and its height 36 ft. The line of the extrados becomes infinite at the distance of 187 ft. from the key stone, and in direction is parallel and as near to the line of the road as is consistent with the stability of the arch. The angular supporters of the centre A K B—A L B, &c. &c. have their several vertices in the circumference *c d e f g* of an ellipse, of which the foci are A B. The ellipse *c d e f g* corresponds very nearly with the curve of the arch. The supporters A K, B K, A L, B L, &c. &c. ultimately abut in the solids D E and P G. By a property of the ellipse the direction of the wedges (*i. e.* of the force) which is at any point perpendicular to the tangent at that point, accurately bisects the angle of the supporters, and the pressure is equally thrown on each. Whilst all lateral strain, which must necessarily arise from an unequal division of the angle by the direction of the force is avoided, and the weight of the stones, as they are successively placed, is equally thrown on the opposite abutments.

From the nature of the curve, and the necessary height of the craft way, it is impossible that the angle of the principals should be bisected by the direction of the forces, unless they pass through the opposite foci, and, save where the direction M g of the force does not bisect the angle of the principals, considerable strain must necessarily result in the direction M f of the tangent; it follows that no centre of an elliptical arch of the given span and height can be free from a lateral pressure on its principals, unless such principals pass through the foci of another curve nearly coincident with it in the angular points of the principals.

Another important advantage results, however, from concentrating the principals. The joints of the timbers being so secured as to resist a diagonal strain as well as a thrust, it is evident, from a slight inspection of the frame, that as the load is successively placed on each succeeding pair of principals, a part and in one case (and that of the greatest pressure) the whole of the remaining beams necessarily act as ties to resist the opposite horizontal thrust, which tends to extend the angle of the principals. Thus, when the loading is placed on I the principals B k, B l, B m, B n, &c. &c. act as ties to prevent the extension of the angle B f A. Again, the opposite beams at O and P being equally loaded and similarly situated, the lateral forces in the direction P a and O a are equal and opposite, and therefore destroyed.

In the same manner it may be shown that, when an equal loading is put on any opposite corresponding pair of principals, the force tending to extend their angles in a great measure is destroyed, and that when the loading is on one side only. The lateral force on the

nearer focus will be taken away, and that on the more distant be diminished by as much force as is destroyed in the other. If the pressure perpendicular to the curve at the vertex  $e$  be supposed equal to unity, the pressure perpendicular to the points  $J I H$ , &c. (varying as the cosine of the angle, which a tangent to the curve makes with a perpendicular to the base) will be given, and this being equally divided on each of the supporters, the horizontal pressure of the load will be found to be  $\frac{a \cos P}{r}$ ,  $\frac{a \cos Q}{r}$  the greater, and  $Q$  the less angle, made by the principals with the base, and  $(a)$  half the perpendicular pressure; hence  $\frac{a}{2} + \cos Q - \cos P = a \times \sin (P + a) \sin P - Q =$  difference of the opposite horizontal pressure, or the force by which the farther focus is forced out. By this formula the whole pressure which the loading of one side will exert on the opposite horizontal pressures, or the force by which the further focus is forced out, will be found to be .6116. If the supporting force perpendicular to the base be supposed equal to unity, the force of  $F x$  inwards will be 4040; hence the inward pressure of the two  $F x$  and  $E y$  will be considerably more than the whole outward pressure, supposing one side only to be loaded. And it has been shown that the equal loading of the sides destroys all lateral pressure.\*

It may be observed that as each succeeding load is placed on the principals, the additional force which must otherwise be thrown on the tie of the next lower principal is taken away, by the thrust which is at the same time exerted on it, and which in fact takes away all strain from the tie, by resisting the expansion of the angle by a superior force. It will be found by examination that the thrust of any succeeding load supplies the place of the ties of the preceding one, hence every additional load in the higher part of the frame gives firmness and stability to the lower.

### NEW DIVISION OF THE THERMOMETER.

LIEUTENANT SKENE, who accompanied Captain Parry in his expedition of 1820, has renewed the idea of dividing the thermometric scale according to the fusion of two solid bodies, and not according to the fusion and vaporization of one, as hitherto has been done. In truth, the circumstances proper to give a fixed degree of temperature by the vaporization of a liquid cannot be united at will, while the fusion of a solid body to a liquid state is determined only by the affinity of the particles of the body for each other and for caloric, and depends upon no other cause. Mr. Skene proposes to establish, as the thermometric unity, the difference of temperature between the degree at which mercury fuses, and that at which ice melts, care being taken that these two substances are perfectly pure. This unity is to be called a degree, and to be divided into 100'. The point at which ice melts

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\* The stays  $F x$  and  $E y$  are, therefore, amply sufficient to support the centre, and keep all lateral pressure from the springing of the arch.

would, as at present, separate the cold from the heat, and be marked 0. The ascending minutes would have the sign  $\times$ , the descending ones the sign  $-$ . An advantage would result by the highest temperatures, even those at which the least fusible metals are melted, being denoted by low numbers. Between the melting of ice and the boiling of water there would not be more than about  $2^{\circ} 50'$ ; zinc would melt at  $9^{\circ}$ , &c.—numbers more easily to be remembered than those at present employed. The graduation of thermometers would certainly be more difficult, and could only be intrusted to skilful artists: this, however, would be of the greatest benefit, fully appreciable, indeed, only by those who have felt to what a degree the scientific world is infested with thermometers on which not the slightest reliance can be placed.

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### LANGTON'S PATENT METHOD OF SEASONING TIMBER.

In this method of seasoning timber the pieces of it are put into a long, vertical, air-tight vessel or cylinder, heated externally by steam, or by a water bath, which latter may be brought to the proper temperature by the common method, or by the use of steam. For either of these methods the vessel or cylinder which holds the timber must be inclosed in a second vessel, prepared so as to contain whichever of the two mediums is adopted for communicating the heat. The internal vessel is to rise a little above this inclosing vessel, and is to be closed with a cover made air-tight, and fastened down in any convenient manner; and in its centre is to be another small lid in which is to be fixed a mercurial syphon guage; there is also to be a screw fixed in it, by turning which a communication may be made with the external air, when the timber is to be removed. The top of the external vessel is to be covered with a flagged platform, on which those, who are to put on and remove the timber, are to stand; and from the part of the internal vessel which rises above this platform, a pipe furnished with a stop cock is to go off sideways to a condensing vessel, below which is to be placed an air-tight vessel for the reception of the liquor which runs from the condenser, and communicating with it by a tube; from the top of this receiving vessel a pipe ascends to an air-pump, and from its bottom another pipe goes to a water-pump, to be used occasionally when the vessel becomes filled with liquor, which is known by a glass tube, fixed to its upper part, which bends round at right angles, and enters into it at its two extremities.

The condensing vessel is composed of a number of vertical tubes, each having at its top, outside, a tunnel, between which and the tube a narrow interval is to be left for the passage of water, which is to be conveyed by separate pipes to the tunnels, and to be let to trickle down the outsides of the tubes to keep them cool. The tops of the tubes may be made to communicate with the main pipe that leads from the timber vessel, either by separate pipes branching off from them, or by rows of lateral pipes, into each of which a certain number of the vertical tubes are made to open. A similar set of intermediate

pipes should be fixed at the bottom of the condenser, to form a communication from the lower ends of the tubes to the pipe that leads to the receiving vessel.

The vessel or cylinder that holds the timber, which is 30 feet or more in length, may be made of several lengths of cast-iron, furnished with flanges by which they may be fastened together, air-tight, with screws and nuts; and when it is to be exposed to steam alone, it should be of such strength as to be able to bear an external pressure of 15 lbs. to the square inch; but when a water bath is to be used, then the bottom of the vessel should be strong enough to bear a force of 30 lbs. to the inch, and the top be of the strength before mentioned; and all the intermediate parts should be proportionably stronger as they are closer to the lower extremity. The bottom of this vessel should also be fastened down to the external vessel, so that if the latter be filled with water while the former is empty, it may be prevented from rising from its place.

Small timber should be kept in the vessel twelve hours, exposed to the action of the air pump and the heat before it is examined; very large timber will require a week to complete its desiccation, and that of intermediate sizes a time between the two periods, proportionate to its dimensions.

The mercurial syphon guage at the top of the apparatus will regulate the heat to be applied to the vessel, and also indicate when the operation is perfected. When it shows a depression of three inches of the mercury, the heat of the bath, or surrounding medium, is to be 130° Faht.; when two inches at a temperature of 120°; and when the mercury is depressed one inch, a heat of 112° is to be applied; but the heat is in no case to exceed 200°.

When it is desired to be known whether the timber is sufficiently exhausted of its juices, the stop-cock of the pipe, that goes to the condenser from the vessel that contains the timber is to be closed; and if, in half an hour afterwards, no rise be observed in the mercury, the operation may be considered to be completed.

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### NEW VAPOUR MACHINE.

“MR. SAMUEL MOREY, an American gentleman, has invented a vapour engine, which in the opinion of competent judges promises to answer well in practice. The vacuum in the cylinder is produced by firing an explosive mixture of atmospheric air and vapour from common proof spirits, mixed with a small portion of spirits of turpentine. A working model has been set in motion and kept at work, without elevating the temperature of the fluid from which the vapour is produced to a higher degree than that of blood-heat. Should no unforeseen difficulties present themselves in its operation on a large scale, it will be the greatest improvement which has been made for many years, particularly in its application to locomotive engines, as the weight of the materials required to keep it in action for a considerable length of time will be so small as not to be worth mentioning.”—*Monthly and European Mag.*

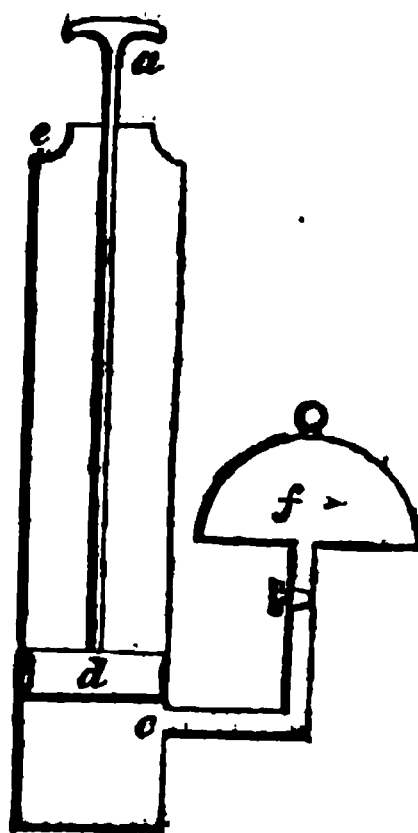
## AIR PUMP WITHOUT ARTIFICIAL VALVES,

BY W. RITCHIE, A. M. RECTOR OF TAIN ACADEMY.

IN the common construction of the air-pump the valves are very liable to be deranged, the repairing of which is attended with much trouble and expense. In the following construction no such derangement can possibly take place, which must of itself give this air pump a decided advantage.

The machine consists of a barrel, shut at the lower end, and having a small aperture at C, forming a free communication with the receiver F; the piston D is solid, and stuffed in the usual way. The piston-rod works in a small stuffing box at A, so as to render it completely air-tight. There is a small aperture at E in the top of the barrel, to allow the air to make its escape when the piston is raised. This air-pump may be worked in the usual way, or by the method of continued motion. In commencing the exhaustion of the receiver, the piston is supposed to be below the small aperture at C. The piston is then raised, and the air which occupied the barrel is forced out through the aperture at E. The point of one of the fingers is applied to the perforation, in the same manner as in playing the German flute. The air easily passes by the finger, which when the piston begins to descend, shuts the opening, and completely prevents the entrance of the external air. The piston is again forced down below the opening C; the air in the receiver rushes into the barrel, and is again expelled by the ascending piston.

Since the air in the receiver has no valve to open by its elasticity, it is obvious that there is no limit to the degree of exhaustion, as in the common construction.—*Jameson's Edinburgh Journal*.



## SPINNING MACHINES.

MR. MOLYNEAUX, of Stoke, Somersetshire, has obtained a patent for an improvement in spinning flax, cotton-wool, and silk. The contrivance is extremely simple, and consists in the adaptation of a peculiar kind of spindle and bobbin, which is applicable to spinners' frames in general; the spindle has no flyer, and the bobbin turns upon a horizontal axle, receiving the filaments of whatever material is about to be spun in a direct line from the drawing-rollers, or from cops or creels, instead of having it conducted at a considerable angle, through the arm of a flyer; the bobbin and the carriage in which its horizontal axle is suspended is made to spin round rapidly, by means of a cord from a drum, as in the old spinning-frames, by which the twist is given uniformly to the whole length of the filaments of flax, cotton, or silk, under operation; and the taking up, or coiling of the

thread, thus spun upon the bobbin, is effected by a wheel affixed to the axle of the bobbin, which is turned by the friction of a horizontal plate, attached to and revolving with the carriage:—*Monthly and European Magazine*.

### COTTON SEED GAS.

From some experiments made by Professor Olmsted, it seems probable that the cotton seed, which constitutes by weight nearly three-fourths of the entire cotton crop, and which, in most of the cotton districts of America, has hitherto been neglected as useless, will be employed as an eligible substance for gas lights. The gas is easily and abundantly obtained from this seed, and affords a degree of illumination quite equal to that of the oil gas, of which indeed it is only a variety, and superior to most varieties of the bituminous coals. It is inferior to the pure olefant gas; and this is the fact with the inflammable gases obtained from perhaps every substance except alcohol decomposed by sulphuric acid. The kernel of the hickory-nut comes the nearest to the olefant, and is but little inferior; the quality of the gas is considerably debased by using the entire nut, the woody covering of which affords a gas which burns with a paler flame. A pound of seed yields 16,288 cubic inches, or more than a hogshhead of the gas. The quantity of seed annually produced in the United States, above what is required for replanting, would afford 2,827,500,000 cubic feet of illuminating gas, but little, if at all inferior to that produced directly from oil.—*Silliman's American Journal of Science*.

### TO W. SHALDERS, OF NORWICH, LEATHER-CUTTER, &c., FOR HIS "NEW INVENTED GRAVITATING EXPRESSING FOUNTAIN,

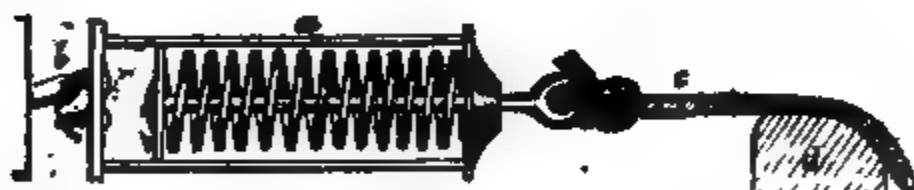
FOR RAISING OR CONVEYING WATER, OR ANY OTHER FLUID, FOR ANY  
PURPOSE."

THIS "new invention" is one of the *oldest* contrivances we ever met with in the specification of a patent. It is of the nature of a force-pump; and, without doubt, is a very effective machine for a temporary purpose, where good pumps are not easily attainable; but the frailty of the materials, and the rudeness of its construction will, we think, prevent its adoption, in the present age, in other cases. The patentee has, we hope, found it to answer his purpose, and we dare say has felt infinite satisfaction in his discovery; but in attempting to secure to himself, by patent right, the exclusive privilege of using the machine, we fear he has "expressed" more money out of his pocket than will ever "gravitate" into it again from the same cause.

It is proper to notice, that a slight liberty has been taken in our graphic illustration, in giving the machine more of the character and appearance of a fountain, than is exhibited in the drawing attached to the specification, which makes it accord, on the other hand, more with the title of the patent.

*a* and *b* are two cylindrical tubes or vats (in section), sunk in the reservoir from whence the water is to be raised: to the upper rim of each of these vats is attached a large leather tube *b d*, secured to it by means of a hoop encompassing both. In the same manner the upper extremity of the leather tube is fastened about midway to the pistons or plungers, *e f*, which are circular-sided boxes, tapering a little downwards; the pistons are connected by rods to the opposite extremities of an alternating lever *o*, which turns upon a central fulcrum, motion being given to it by a steam-engine, or any other adequate first mover. At *i i* are two suction pipes, with valves opening *inwards*, through which the water *gravitates* into each vat alternately, as their respective

pistons are successively raised; on the descent of the same, the foot valve in the cylinder is opened in each reciprocally, and the water is thereby *expressed* up the pipe *k*, forming at *l*,—"THE PATENT GRAVITATING EXPRESSING FOUNTAIN."



### BURNET'S PATENT IMPROVEMENTS IN SHIP'S TACKLE.

THIS is an old invention applied to a new and useful purpose by the patentee, Mr. William Shelton Burnett, of New London Street. Our readers will perceive, from the above diagram, that it is nothing more nor less than the common pocket weighing steelyard; and, in its new application, it is only required to make them of greater capacity and strength; the object being to take off the sudden and undue strains, to which not only the cable but other parts of a ship's tackle are liable, by the heaving and rolling of the vessel. The apparatus consists of a cylindrical metal-box, *a*; containing a spirally coiled spring, through the centre of which passes, longitudinally, a

bar; one end of this bar is strongly rivetted to an iron plate, and the other terminates in a large eye for the reception of a hook or a rope.

Now, supposing the cylinder *a* to be made fast at *b* to some stable part of a ship, and the cable *c*, which passes over the side of a ship *d*, to have an anchor attached to the other extremity; when any strain comes upon it (from the before-mentioned causes) the bar is drawn more or less out of the cylinder, compressing the spring; thus affording an elastic resistance, which continually increases with the force applied, will prevent those accidents of tearing away the fastenings, which might without this apparatus be the result. It is of course, obvious to the reader, that this "compensating apparatus" (as it is termed by the patentee) is equally applicable to any other tackle or rope, which it will always keep in a proper state of tension, after the cause of the adventitious strain has ceased to operate.

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## History of the Steam Engine.

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### CHAPTER IV.

CONTENTS.—HORNBLOWER'S ENGINE.—BURGESS' ROTATIVE FROM VIBRATORY MOTION.—COOKE'S ENGINE.—BRAMAN AND DICKINSON'S ENGINE.—SADLER'S ENGINE.—CARTWRIGHT'S ENGINE.—HORNBLOWER'S ROTATORY ENGINE.—MURRAY'S BOILER, &c.—MURDOCK'S ROTATIVE ENGINE.—CLOWTHER'S CRANK MOTION.—CARTWRIGHT'S PORTABLE ENGINE.—MURRAY'S AIR PUMP AND VALVES.—BRAMAN'S VALVE.

FROM a wish to keep our description of Mr. Watt's discoveries as connected as we could, we have, until now, passed over the invention of Mr. Jonathan Hornblower, of Penrhyn, Cornwall, for which a patent was taken out in 1781. A full and detailed description is to be found in the first edition of Gregory's Mechanics. The following is a copy of his specification.—

"First,—I use two steam vessels in which the steam is to act, and which in other steam engines are called cylinders. Secondly,—I employ the steam after it has acted in the first vessel to operate a second time in the other, by permitting it to expand itself, which I do by connecting the vessels together and forming proper channels and apertures, whereby the steam shall, occasionally, go in and out of the said vessels. Thirdly,—I condense the steam by causing it to pass in contact with metallic substances, while water is applied to the opposite side. Fourthly,—to discharge the engine of the water employed to condense the steam, I suspend a column of water in a tube or vessel constructed for that purpose, on the principles of the barometer, the upper end having open communication with the steam vessels, and the lower end being immersed in a vessel of water. Fifthly,—to discharge the air which enters the steam vessels with the condensing water or otherwise, I introduce it into a separate vessel, whence it is protruded by the admission of steam. Sixthly,—that the condensed vapour shall not remain in the steam vessel in which the steam is condensed, I collect it into another vessel, which

has open communication with the steam vessels, and the water in the mine, reservoir, or river. Lastly,—in cases where the atmosphere is to be employed to act on the piston, I use a piston so constructed as to admit steam round its periphery, and in contact with the sides of the steam vessel, thereby to prevent the external air from passing in between the piston and the sides of the steam vessel."

This patent, like Watt's, conveys no idea of either form or dimensions; and we must therefore have recourse to other sources for more particulars respecting it. We have already said that an enlarged detail is to be found in the first edition of Gregory's *Mechanics*; but we content ourselves with a shorter one. The first and enlarged account written by Mr. Hornblower, was afterwards omitted by Dr. Gregory, who, in a subsequent edition, makes the following remarks thereon.—"As I have been exposed to much calumny and misrepresentation for admitting that historic sketch into my work, I beg to remark that I did it *solely* from motives of benevolence. Till the time my second volume was preparing for the press, I knew nothing of Mr. Hornblower; but a friend of mine, on whose judgment I placed great reliance, who was well acquainted with Mr. H. and thought highly of his moral character, as well as of his mechanical skill, had a full persuasion that, through a series of unfortunate circumstances, he had never had justice done him, and urged me to allow Mr. Hornblower to tell his own story. I yielded to his solicitations, and in consequence exposed myself to the malevolence of certain writers, who, in one short note of ten lines,\* published *four* positive, wilful falsehoods, for the honourable purpose of injuring my reputation. I, however, forgive them, although they treated me unjustly; and trust they will, ere now, have forgiven me for permitting an injured (though perhaps hasty) man, to defend his own cause and that of his family. He is now beyond the reach of those who wished to promote his welfare, as well as those who, by unfairly depreciating his character, involved him in ruin. His latter years were rendered comfortable, not by the liberality of his countrymen, but by an opulent and scientific *Swede*, who knew how to appreciate and to reward his merit as an engineer."†

"The principle of Hornblower's engine consisted in obtaining more power by a complicated force of steam than could be acquired by its simple action in the common mode. This is effected by the use of two cylinders of different capacities. And Mr. H. after inquiring into the effect of using steam according to each of these modes, compares the results together as follows. 'If we obtain the accumulated pressure by taking a mean of the extremes, we shall find Mr. Watt's application to be  $\frac{21 \times 21}{2} = 20$ , leaving 12 lbs. at the termination of the stroke. The application of the principle in the present instance, by taking the mean of the two extremes, will be  $\frac{21 \times 21}{2} = 21$ , leaving

\* Edin. Review, vol. xlii. p. 327.

† We need scarcely remark here on what must appear evident to all, viz. that, by this short explanation, the Doctor's conduct in this affair rises by his benevolence and generosity of heart far above the malevolent attacks of interested writers; whilst it excites in the breasts of every reader the deepest commiseration for the injuries of the neglected Hornblower.

is at the termination of the stroke; which, in point of advantage, is favor of the double cylinder, is as 3 to 2; a point of no small magnitude in the practical application of this principle, and which seems to have been overlooked by all those who have taken up the subject.

The accompanying figure will explain the principle of this engine, which is given without the parts in connection, those being, in common with Watt's engine, already given.—*a* & *b* are the two cylinders; *a* being the smaller one, which has a piston *c* fitted to the interior; this cylinder is in communication with the boiler by the

pipe *e*. Other pipes and cocks, *x* & *y*, are attached to each cylinder, and open a communication with both sides of their pistons. *e* is a pipe with a stop cock, which opens a communication between the bottom of the cylinder *a*, and the top of the large cylinder *b*. *f* is a pipe and cock leading to the condenser *g*, its pump *h*, placed, as usual, in cold water; these are the same as those used in Mr. Watt's engines. Steam comes from the boiler to the pipe *e*; and its flow may be prevented by the cock *k* to allow the passage of steam from the boiler, and the cocks at *x* & *y*, to be all open; which will allow the steam to fill both cylinders. The cocks at *k* and *g* must now be closed, *e* and *h* remaining open.

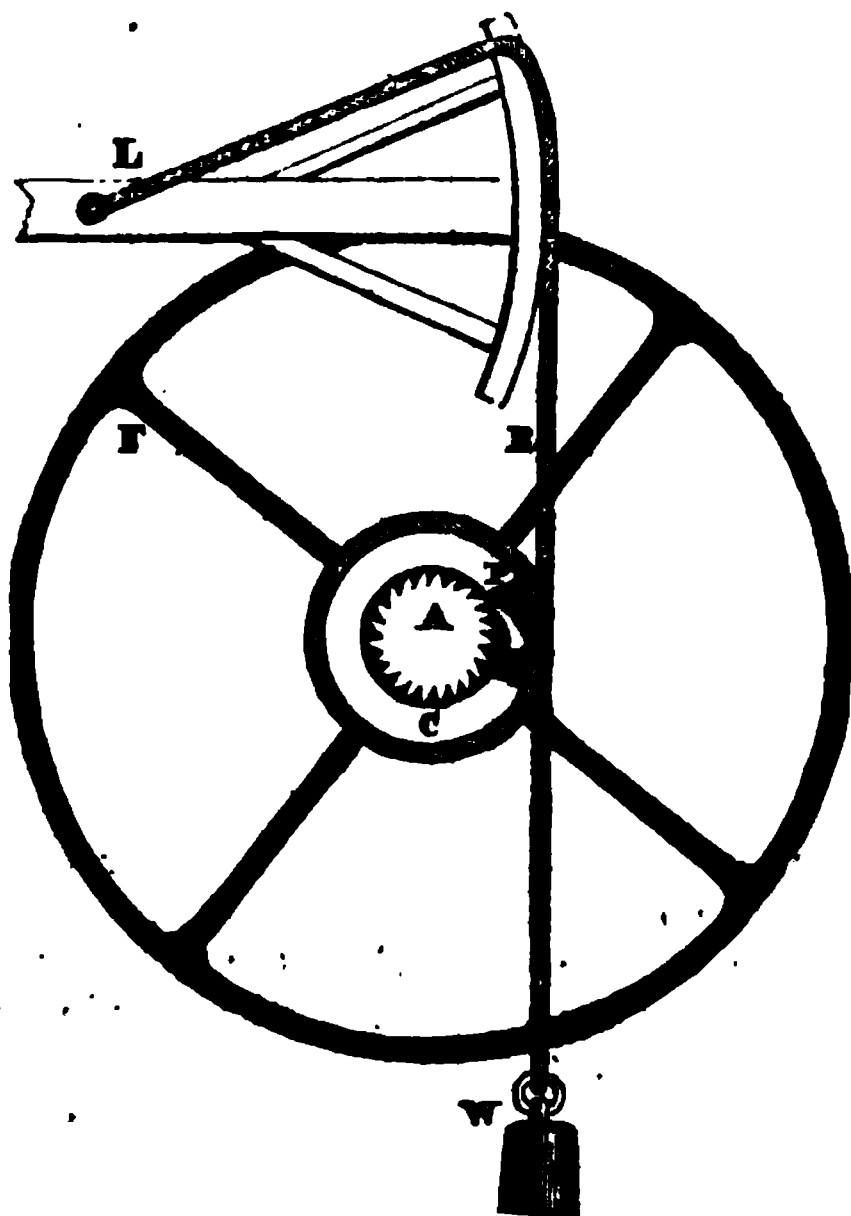
By turning cock *f* a communication is opened between the under side of the piston *v*, and the condenser which forms a vacuum in *b*. The steam pressing on the upper side of *s* in *a*, and the communication between the cylinder *a* under its piston *s* being open, the steam in *a*, from its expansive power, will press *v* downwards in *b*. This decreases the resistance in the under side of the piston *s*, which is also carried downwards by the pressure of the steam flowing through *k* from the boiler; and the two pistons descend at the same time, carrying the beam along with them. When they reach the bottom of the cylinders, the cock *f* shuts off the communication with the condenser, and the cock *e* with the top and bottom of the two cylinders. The cocks in *y* and *x* are now opened, which allows the steam in each a free communication between the upper and under sides of these pistons, or between that of the last cylinder and condenser; and the counterpoise at the other end of the lever beam raises the pistons to the top of their respective cylinders, or the pipe *y* may form a communication with the piston and the condenser. *s* and *y* are now shut, and *e f* and *k* are now opened, and the operation is repeated.

A drawing and description of a rotative engine, by Mr. Cooke, are to be found in the Transactions of the Royal Irish Academy, 1787. We subjoin a description thereof.

On the circumference of a wheel eight vanes or flaps are attached by joints, which are formed to open somewhat more than half of their circumference. During the revolution of the wheel the valves, which are on the lower half of its circumference, hang in a vertical

direction by their own gravity. *c c c* are the valves or flaps; *b* is the tube which admits steam from the boiler; *a* a tube leading to the condenser. *k k f* is the case in which the wheel *k k* is enclosed as high as the dotted line: this case is to be steam-tight. The wheel being supposed in the situation in the figure, the valves prevent any communication between the boiler and condenser. Steam is now admitted at *b*, and, pressing on *c c*, forces them forward in its passage to the condenser and produces movement. The condenser is worked by a crank in the axis, and a rod *d* is extended from it which keeps a constant vacuum in that half of the steam case:—  
 “by this means a power is added to the steam equal to the weight of the atmosphere; so that, when the force of the steam is only equal to the pressure of the atmosphere, and the valves are six inches square, the wheel will be forced round by a power equal to 531½ lbs. placed on its circumference.” The construction of this machine we need hardly say would be impracticable. Friction out of the question, the imperfection of the mechanism, and the clumsiness of the whole engine, are too apparent to need any detail.

Mr. Thomas Burgess obtained a patent, in 1789, for a method of producing a rotary motion from the action of an alternate movement. We are induced, from the probability that few of our readers are acquainted with it, to give it a place here.



Upon an axis *A*, to which the rotary motion is to be communicated, a collar *C* is accurately fitted so as to turn freely thereupon,

and so secured in its place as to prevent its sliding sideways; round the collar a chain or rope R, is to be wound; one end of the rope is made fast to the lever L, of a steam engine, or other alternating moving power, which motion may be horizontal, vertical, or in any other direction: to the other end of the rope a weight W, is suspended, which is to draw the collar C back, in the interval between each stroke or impulse of the moving power. Inside of the barrel or collar C, is fixed a pall or catch, P, which falls by its own gravity into the notches of the axle A, so that, when it is acted upon by the moving power in one direction, the axis A becomes locked to the collar, and the fly wheel F, is forced into a rotary motion. When the action is reversed by the alternating motion of the lever L, the collar is released and runs back, the pall sliding over the notches in the axis without impediment, the original rotary motion continuing in the fly wheel, by the impetus given it at every alternate stroke of the lever.

This machine needs no comment, it is infinitely inferior to the crank which was in use prior to the date of this patent: it is, notwithstanding, very ingenious; and fifteen or twenty years sooner might have been considered as a convenient and useful method of obtaining the desired end.

## Discoveries & Processes in the Useful Arts.

**VALUABLE DISCOVERY.**—One of the most recent and useful discoveries in husbandry, consists simply in mixing layers of green or new-cut clover, with layers of straw in ricks or stacks; thus the juices of the clover are absorbed by the straw, which thus impregnated, is greedily eaten by horses and other cattle, and the clover is dried and prevented from heating. This practice is particularly calculated for second crops of clover and rye grass.

**NEW VAPOUR-ENGINE.**—"Mr. Samuel Morey, an American gentleman, has invented a vapour engine which, in the opinion of competent judges, promises to answer well in practice. The vacuum in the cylinder is produced by firing an explosive mixture of atmospheric air and vapour from common proof spirits, mixed with a small portion of spirits of turpentine. A working model has been set in motion, and kept at work, without elevating the temperature of the fluid from which the vapour is produced to a higher degree than that of blood heat, should no unforeseen difficulties present themselves in its operation on a large scale, it will be the greatest improvement which has been made for many years, particularly in its application to locomotive engines, as the weight of the materials required to keep it in action for a considerable time will be so small as not to be worth mentioning."—*Monthly Magazine*.

**LAC-RESIN.**—In India the British cultivate the gall insect, for the purpose of obtaining the lac; after the manner of cultivating the cochineal fly in South America. In China the culture of another

kind of fly is encouraged for the production of a fine wax, with which candles are there made.

**PRESERVING OF POTATOES IN A DRIED STATE.**—Wash them, cut them in pieces, steep them 48 hours in lime-water, then 48 hours in fresh water; dry them in an oven. One hundred parts of fresh potatoes will give thirty so prepared and dried. In this state they may be kept for years, or ground at once into flour: this flour mixed with a third part of that from rye, is said to make excellent bread. The same author proposes to moisten potatoes dried as above with olive oil, and then to grind them, and use them as coffee.

**SPONTANEOUS INFLAMMATION OF CHLORINE AND OLEFIANT GAS.**—Dr. Silliman has had occasion to observe the spontaneous inflammation of a mixture of chlorine and olefiant gas, and warns chemists against its re-occurrence unawares. It took place, apparently, in consequence of mingling the gases in such a way, that the olefiant gas occupied the upper part of the receiver, and the chlorine the lower; the two being in contact, but generally very distinct from each other. After remaining in this state a few minutes, a bright flash pervaded the bell-glass, which held five or six quarts. It was raised out of the water with a slight report, a dense deposit of charcoal lined the vessel, and covered the water, and the chlorine disappeared.—*Silliman's Journal*. x. 365.

**FLIES.**—In Japan the inhabitants employ a species of lizard, called *geckhoes*, for ridding their apartments of the flies; the geckhoes constantly pursue these insects for food.

**PAPER.**—The brothers Cappucino, paper makers at Turin, have found the means of supplying the want of rags, by the fabrication of a new kind of paper, from the thin bark of the poplar, willow, and other kinds of wood. The Academy of Science having examined the specimens thus produced of writing, printing, and wrapping paper, acknowledge the goodness of them, and praise the invention: so that his majesty has granted to the brothers an exclusive privilege for ten years, for the manufacture of paper from ligneous materials.—*Journal de Turin*.

**DEPTH OF AMERICAN LAKES.**—Lake St. Clair rarely exceeds four fathoms. Lake Erie from 25 to 35 fathoms. Lakes Huron, Michigan, and Superior are, in places, 900 feet in depth, sinking to about 300 feet below the level of the sea.—*Silliman's American Journal*.

#### LIST OF NEW PATENTS.

**ORDNANCE.**—To Lieutenant Thomas Hulahan, York Street, Dublin, R. N., for his apparatus for working ordnance. Sealed 22nd June. Six months.

**PAPER MAKING.**—To Louis Aubrey, Two Waters, Engineer, for improvements in the web or wire for making paper. 14th July. Four months.

**STEAM-ENGINE BOILERS.**—To John Poole, Sheffield, shopkeeper, for improvements in the steam engine boilers. 4th July. Six months.

**COLLAR MAKING.**—To Daniel Freeman, Wakefield, saddler, for improvements in measuring for and making collars. 4th July. Six months.

**PAINT.**—To Peter Groves, Liverpool Street, Esq. for improvements in making paint, or pigment, for preparing and combining a substance with oil, turpentine, &c. 14th July. Two months.

**PIANO-FORTES.**—To Robert Warnum, Wigmore Street, piano-forte maker, for improvements in piano fortes. 4th July. Two months.

**WHITE LEAD.**—To Peter Groves, Liverpool Street, London, Esq. for improvements in making white lead. 4th July. Six months.

**PINS.**—To Benjamin Lowe, Birmingham, gilt toy manufacturers, for improvements in useful and ornamental dressing pins. 14th July. Two months.

**STRAW HATS.**—To John Guy and Jacob Harrison, Workington, Cumberland, straw hat manufacturers, for an improved method of preparing straw and grass. 14th July. Six months.

**SHIPS.**—To John Palmer de la Fons, George Street, Hanover Square, dentist, and William Little Want, of St. Mary Axe, mathematical instrument maker, for an improvement in securing or mooring ships or other floating bodies, and apparatus for performing the same. 14th July. Six months.

**WOOL.**—To Edward Bayliffe, Kendall, Westmoreland, worsted spinner, for certain improvements in machinery, used for drawing, roving, and spinning of sheep and lambs wool. 14th July. Six months.

**SHIP-TACKLE, &c.**—To John Lane Higgins, Oxford Street, Esq. for certain improvements in the construction of cat-blocks and fish-hooks, and in the application thereof. 14th July. Six months.

### LIST OF PATENTS, EXPIRED IN JULY, 1826.

**GUN-LOCKS.**—To William Smith, of Lisle Street, Middlesex, for an improved gun and pistol lock.

**AXLE-TREES.**—To John Bellingham, of Levens, near Restevor, Downshire, for improvements in the construction of axle-trees.

**IRON MANUFACTURE.**—Henry Osborn, of Bordesly, near Birmingham, for an improved machine for turning and levelling iron articles, preparatory to welding and grinding.

**IMPROVED GEARING.**—To John Rapson, of Penryn, Cornwall, for an improved method of communicating a regular and irregular motion from one axle-tree to another, placed at any angle, without the aid of an universal joint.

**PUMPS.**—To R. Thompson, of North Shields, for a new mode of working two or more pumps in ships, mines, &c.

**JAPAN WORK.**—To Thomas Hubball, of Clerkenwell Close, and W. R. W. King, of Holborn Hill, for a method of ornamenting articles japanned, painted, &c.

**GREEN PAINT.**—To William Parker, of Whitechapel, Middlesex, for an improved green paint.

**SADDLE-CLOTHS.**—To James Goodman, of Northampton, for an improved saddle-cloth, to prevent the saddle from running forward on a horse.

**LACE.**—To John Renshaw, of Nottingham, for a method of making spots in lace or network.

### TO CORRESPONDENTS.

A CHEMIST, on the Preparation of Isinglass, is intended for insertion in our next.

If the Aerostatic Machine, mentioned by A CORRESPONDENT, can be made to perform, automatically, all the necessary evolutions of a vehicle for expeditious travelling in any required direction at the will of the aeronauts;—if, indeed, a machine can be made to do this, there can be, we think, no question as to the policy of securing, by patent right, the advantages that will result from so important a discovery.

The communication signed JOHNSON & Co. was received only just as we were going to press, owing to its having been wrongly directed.

W. I.—A Mechanic,—and a Constant Reader,—are received.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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## EVANS'S PATENT DISTILLING APPARATUS.

When a body is subjected to the direct action of heat over a furnace, that part of it upon which the fire impinges, must necessarily receive its effects first, and in proportion to its conducting power, communicate the same to the superincumbent portions. If a retort be charged with wood, as in the old method of dry distillation, that part in contact with the heated iron will become carbonized, before that in the middle which is not in contact with it; but, before the whole or any part can have been sufficiently acted upon to produce this effect, the fire must separate those elementary principles, which with carbon constituted the previous combination. Now, as these elementary principles are known to combine in different proportions, and form new substances, at different degrees of temperature; it follows, that when the heat is unequally applied to the substance under distillation, that a variety of products come over at the same time.

The ultimate constituents of all vinous liquids are found to be carbon, oxygen, hydrogen, and nitrogen; the several products which result from their distillation are formed at various temperatures, and these are found to be compounded in various proportions of the same elementary principles; therefore, in subjecting such liquids to distillation by the *ordinary alembic or still*, similar effects must take place to those first described, as resulting from dry distillation by the usual apparatus. A boiler charged with a quantity of "wash," or wine, being *fired* over a furnace, those parts which are nearest to the fire, will undergo changes varying materially from those more remotely situated, and thus an empyreumatic oil is formed, which combines so intimately, on its creation, with the spirit produced at the same time, that no perfect means have yet been discovered to separate them. Thus we may account for those peculiarities which distinguish spirits drawn from the wine of grapes, the wine of malt, of molasses, &c. Alcohol, however, would be precisely the same, from whatever vegetable substance it might be obtained, were it not tainted with empyreuma peculiar to the wine.

Upon the whole we think it is evident, that an uniform degree of heat cannot be given or maintained in still boilers of the ordinary construction, and consequently that "perfectly clean spirits" (which the distillers talk of, but never obtain), will never be produced, without a radical change in the form of the vessels, as well as in the mode of operating.

We shall introduce our description of Mr. Evans's New Apparatus, by which he proposes to remedy the defects of the old system, by inserting some observations made upon it by the intelligent Editor of the Monthly Magazine, which appeared in July last; the invention is there announced in the following terms.

"Mr. Evans has constructed the model of a still upon a new principle, which if it answer on a large scale, will altogether supersede the old alembic. The theory of the machine is such, that it may without hesitation be pronounced the most decided improvement

hitherto effected; for if we mistake not, the still at present in use remains in principle precisely the same, through the operation of the excise laws, that it was a century ago. Whatever improvements have been attempted apply only to the rectification, while the first formation of the spirit is conducted in the same rude manner as in the infancy of science. We forbear entering into a more particular description until the design be carried into execution upon a large scale. We should be extremely sorry by premature publicity to afford the continental distillers an opportunity of maintaining the superiority they have hitherto enjoyed, and we feel convinced that we shall now take the lead in this important branch of our productive industry. The new apparatus eminently combines economy in practice and simplicity in construction; but the most valuable attainment is the production of pure untainted spirits, which may be drawn in one operation at any point of strength."

The several patents for England, Ireland, Scotland, and France, being either completed or secured, we have the sanction of the ingenious projector for giving the subject full publicity. We have accordingly made such a drawing of the apparatus, as to shew the whole operation at one view; the engraving from which forms the frontispiece to our present number.

*a* is a pipe which conveys the 'wash' or fermented liquor into a reservoir *b*, where it is maintained at a certain level by the ball valve *c*. *d* is the still, which is a revolving copper cylinder, with ledges fixed in horizontal lines against the inner surface to increase the agitation of the wash, as it turns upon its hollow axis *f g*: its motion is derived from the spur wheel *k* acting upon the pinion *i*, fixed on the hollow axis *f*. *j* is the rectifier; this is formed of a large pipe of uniform bore, coiled up into the spiral figure exhibited, with the ends bent so as to form axes for rotation, on one of which a pinion *k* (corresponding with that at *i*) is fixed, and this pinion is acted upon by another spur wheel *l*, on the same shaft as the other: *m* is the common distiller's refrigeratory, and *n* a receiver for the distilled spirit. The figure represented in dotted lines is intended to shew the position in which the still is drawn up, when it is necessary to cleanse it; for this purpose there is at *e*, an universal joint of a peculiar construction, which enables it to be easily done after having separated the connected tubes at the union joint, represented contiguous thereto.

The rectifier *j* communicates with the still through the hollow axle *g*, and with the refrigeratory through a stuffing box; and the still communicates with the reservoir by means of a syphon passing through the hollow axis *f*. The outward part of the syphon has two unequal limbs; the short limb inserted in the reservoir is for the purpose of charging the still with the wash, and the long limb for the purpose of discharging the spent liquor.

The operation is one of singular elegance, and our readers will, we doubt not, agree with us that the novel and simple contrivances by which it is effected, evince a mechanical genius in the contriver of no ordinary description.

In order to charge the still the ball of the valve is pressed downward so as to raise the liquid above the top of the syphon; this sets the syphon in action, and causes it to fill the still to the same level as the liquid in the reservoir. Thus prepared, the fire is lighted, and a slow rotatory motion given to the still by hand, or any other convenient first mover, applied to the shaft, upon which the spur wheels *h* and *l* are fixed. It matters not how fierce the fire may be, the continuous motion of the liquid prevents the formation of empyreuma, and those other ill effects incident to spirituous liquids in a fixed boiler. The agitation of the liquid in this vessel, and the intensity of the heat applied, causes a rapid production of vapour which immediately enters the hollow axis *g*, and passes into the coiled worm of the rectifier *j*. It is here necessary to observe that this capacious worm revolves in that direction pointed out by the arrow, consequently whatever portion of the vapour becomes condensed in it, runs out at every revolution, back through the hollow axis *g* into the still; and the hollow axis *g* is, for this purpose, made tapering wider towards the still, so as to give the liquid a descent to run freely into it.

The vessel *j* is, therefore, properly termed a rectifier, as it separates the water from the diluted alcohol, before passing out of it into the refrigeratory *m*; in this it arrives in a state more or less concentrated, according to the temperature preserved in the rectifier, which is regulated as usual by a thermometer; the spirit may, consequently, be drawn at one operation of almost any required strength.

A very interesting feature in these new arrangements is the mode of applying the syphon; which is constantly supplying the still with fresh wash, in place of that which has been vaporized, and this operation is uniformly continued during the rotation of the vessel, owing to its passing through a tubular axis: the syphon, in like manner, enables the still to be discharged without stopping the machinery. When it is necessary to recharge the still with the fire under it, a thick cast-iron sliding plate is drawn from the back, so as to interpose itself between the fire and the still, and thus prevent any injurious effects to the contents of the latter. When fuel that does not emit much smoke, such as coke, or anthracite, is employed, the grate itself may be drawn out from under the still by placing it upon castors or rollers, and without inconvenience, as the time necessary to renew the operation of charging, sufficiently to prevent burning, is only the work of a few moments.

We shall here close our remarks, by acquainting our readers that this invention does not emanate from the wild speculations of a mere theorist; for Mr. Evans is an inquiring practical man; and his observations, and his experiments, have convinced him that alcohol is *not* altogether the result of the vinous fermentation, but *the product of a subsequent elementary change*, effected at a higher temperature, which hitherto could not be ascertained, for the want of an apparatus such as we have described. Upon Mr. Evans's principle of construction, any temperature may be uniformly applied to the whole mass of liquor; while by the old vessels this is impossible to be done without injury to the products, for reasons before given.

It is likewise particularly deserving of notice, that there is a considerable economy in the application of heat by this method, for the fire acts uniformly upon the whole surface of the still, but in those of the ordinary construction the fire does not act upon more than one third, or one fourth of the surface.

### **London Mechanics' Institution.**

On Friday, August 11, Dr. BRAXBECK delivered to the members of the London Mechanics' Institution, the first of a series of Lectures on Miscellaneous subjects, principally relating to modern Mechanical Inventions.

The worthy Lecturer commenced with some observations on the inconsistency into which philosophers are liable to fall, when they attempt to describe the intimate nature and properties of the atoms of matter. An instance of this, he remarked, we may find in the recently published work of an ingenious and justly-esteemed philosopher, in which we read—

1. The particles of matter are solid, and occupy space.
2. They are impenetrably hard.
3. They are infinitely divisible.
4. They are mobile, but inert.
5. They universally attract and are attracted.

Now it is impossible not to observe, that there are here two properties apparently inconsistent; for, it must be evident, that if the particles of bodies are impenetrably hard, they cannot be divided at all, so that this is in fact saying they are divisible and not divisible at the same time.

Although, however, we cannot arrive at a complete knowledge of the nature of these atoms, yet, by observations on masses, we may obtain some information as to their relative distances. Thus we know that the particles of a piece of iron are very near each other, yet they admit of separation, and we are also aware that these particles may be made to approximate by hammering. This latter proposition was proved experimentally, by an hydrostatic balance. Other metals exhibited the same phenomenon. Thus platinum, the heaviest substance known, has, in its original state a specific gravity of 19.7; by hammering it is increased to 20.3; when drawn into wire its specific gravity is 21.4; and when it has passed through the laminating rollers it is increased to 22.6. The approximation of the particles of bodies was further illustrated by reference to the diminished bulk of two cylinders of copper and tin, after fusing them together to form an alloy.

But our knowledge of solid bodies is not confined to the mere distances of the particles. If we take a piece of iron and bend it, it takes what is technically called a set, but if we place moderately hardened steel in similar circumstances, it will, when permitted, resume its original position. This remarkable difference arises principally from the introduction of about  $\frac{1}{1000}$ th. part of its weight of

carbon between the particles of the iron —This subject the Doctor promised to explain more fully in a future lecture, when he would also introduce the mode of making steel in Hindostan,—a mode unquestionably superior to ours.

The Lecturer then alluded to the elastic property of cork, which rendered it so useful in preserving bottled liquors, and introduced an ingenious machine for corking bottles and another for bottling liquors, the former invented by Mr. John Masterman, the latter by Mr. Thomas Masterman.\*

Dr. Birkbeck next adverted to the compression of wood in general.—This he observed could not be carried so far as in cork, yet the effect was sufficiently perceptible, and unlike cork, it was permanent.†

The alteration that can be effected in the distance of the particles of liquids, is so small, that for a long time, water was thought to be incompressible. The Florentine Academicians took a globe of gold and having filled it with water, submitted it to the action of a powerful press, after a short time it was perceived, that the water rather than suffer compression had forced its way through the pores of the gold and stood like dew on its surface.—This experiment the Doctor observed was inconclusive; but the experiments of Mr. Canton and Mr. Perkins had put the compressibility of water beyond a doubt. Mr. Canton found a sensible difference in the height of water in a glass tube, by the removal of atmospheric pressure. The pressure of the air being removed, the water stood .42 or nearly  $\frac{1}{2}$  an inch higher than before. Mercury being treated similarly rose the thirty-second part of an inch. In this experiment the expansion of the water was estimated at the  $\frac{1}{1000}$  of its bulk. More recently Mr. Perkins, reflecting on the well known fact that a bottle on being sunk a considerable depth into the sea has its cork pushed in, conceived that water must be compressible, to prove which, he took a brass cylinder, and having fitted into it a piston, on the rod of which close to the cylinder he placed a brass ring, which by means of a spring would remain at any point on the rod to which it might be pushed, he lowered the apparatus 500 fathoms deep into the sea. On subsequent examination it was found, that the ring stood at 8 inches above the stuffing box, shewing that the piston had been forced through that depth into the cylinder. The amount of condensation in Mr. Perkins's experiments is double that in Mr. Canton's, but as Mr. Perkins is still engaged in experiments on this subject, it may be expected that these differences will be explained.

Dr. Birkbeck next adverted to the compressibility of aeriform bodies which he illustrated by means of a condensing machine. The compression of gaseous substances had been applied to a common and useful purpose of life. In the portable Gas Lamps, a gas is compressed into  $\frac{1}{10}$  of its original bulk. On the introduction of gas

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\* For a full description of these highly ingenious and useful machines, see Register of Arts, No. 72.

† The patentee's account of this important invention is given in No. 55 of this work.

lighting, many persons thought that the gas would not pass through the pipes merely by the pressure of the gasometer, and this opinion was founded on some experiments that had been made by Mr. Papin and Mr. Wilkinson. These gentlemen severally attempted to procure a current of air, at the extremity of a tube a mile and a half in length, by compression in the one case, and rarefaction in the other. Both these experiments failed; the event had not justified the opinions formed on the subject, but if it had, the oil gas would still have been at our command. Many difficulties occurred to Mr. Gordon in the prosecution of his undertaking, but his genius and perseverance at length overcame them all. The Doctor then entered into a circumstantial account of the manner of compressing the gas and filling the lamps.\*

In a comparative statement of the quantity of light produced by this and coal gas it was stated, that 12 wax candles burning steadily for one hour would produce as much light as 2600 cubic feet of olefiant gas, 4857 of oil gas, and 13120 of coal gas. The composition of the coal gas is 1 atom carbon, and 1 atom of hydrogen, and of the oil gas, 2 atoms of carbon, and 1 of hydrogen; to this greater quantity of carbon in the bi-carburetted hydrogen, or oil gas, may be attributed its superior light.

Leeds, 19th August, 1826.

*To the Editor.*

SIR

Being a constant reader of your very interesting work, I have felt somewhat disappointed in your having hitherto omitted to notice the valuable and important inventions of my ingenious townsman, Mr. Matthew Murray, whose various improvements in the steam engine alone, fairly entitles him to a place in every work on mechanical science.†

Mr. Murray has, I am informed, devoted much of his time latterly to the improvement of loco-motive railway carriages, in arranging their several parts, and the proportions of these parts, more judiciously than heretofore; by which their effective services have been considerably augmented. I have before me a diagram of one of these carriages, which I transmit in the hope of your giving it insertion in the Register of Arts, should it appear to you deserving of it.

Your obedient Servant,  
S. WHITLAW.

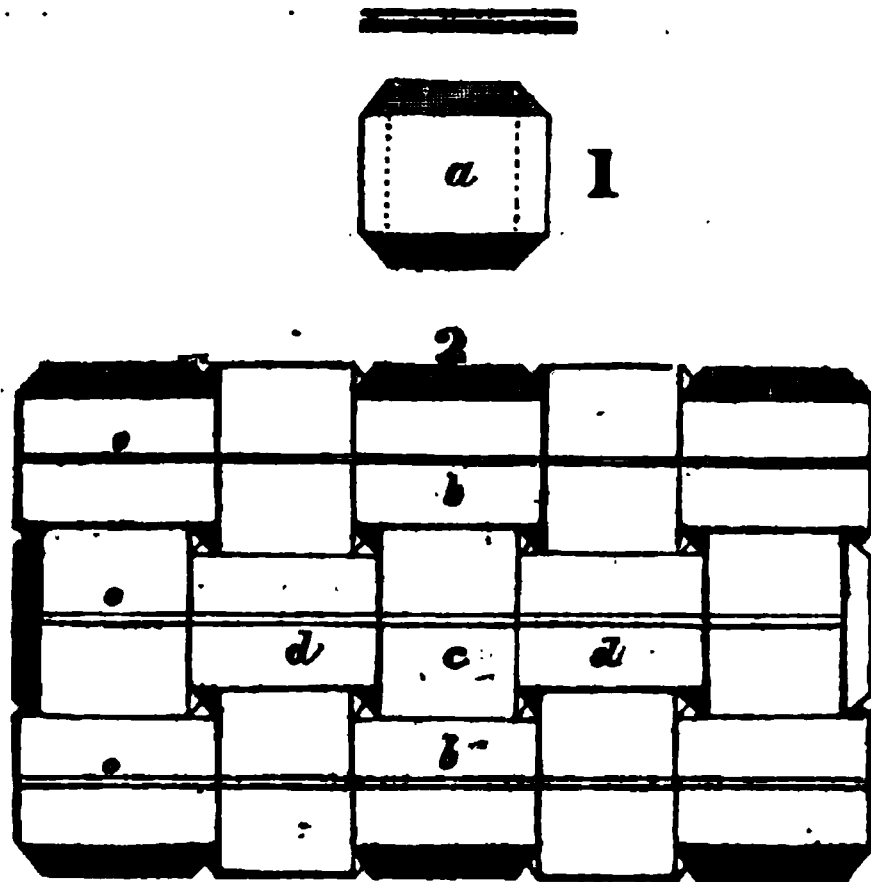
A is an edge railway, B the steam engine, C the boiler and its carriage, to which may be attached the train of loaded carriages.

\* A description and full account of the London Portable Gas Works with engraved representations, together with an exact account of the whole process, is given in the 59th number of this work; in our 66th number will also be found a vertical section and description of the forcing pumps.

† Our correspondent has by this time probably perused our last number, wherein he will observe, page 153, that descriptions of Mr. Murray's boiler, and his air pump and valves will shortly appear from the pen of Mr. Galloway. Ed.

The boiler is nearly filled with water, in the centre of which is fixed the furnace and flue *d*; the coals are supplied by the hopper *e* above, which being provided with a roller and flap valve, is operated upon by the running wheels of the carriage, so as to deliver a determinate quantity at intervals; the heat of the furnace is regulated by means of a damper in the flue at *f*, or by altering or by stopping altogether the supply of coals to the boiler, which is effected at pleasure by the winch at *g*. The steam from the boiler is conveyed by the tube *h h*, and enters the two cylinders *i, j*, the valves being open and shut in the usual manner: the cylinders have each a casing of wood to prevent the loss of heat by radiation: the condensers are placed under the cylinders at *k k*: the pistons in the working cylinders which are operated upon alternately by the steam, act reciprocally by their rods upon the extremities of two distinct lever beams *l l*; these are supported at their opposite ends by two upright rods *m m*; and the points of connection of these parts being jointed, namely at *n n n*, and *o o o*, the piston rods are enabled to work uniformly in a vertical direction; at *p* is a cogged wheel, with a crank on each side, to which the impulse given to the vibrating beams *l l* is communicated by means of the rods *q q*, and the cranks being placed at about 90 degrees apart in the circle, the force upon it is equalized. The wheel *p* actuates another toothed wheel *r* on the axis of the fore-running wheels *s* which are thereby propelled forward; and the fore and hind wheels being connected together by a rod *t* they are thereby propelled simultaneously. The hind wheels of the engine carriage and the *fore* wheels of the boiler carriage are connected by means of an endless chain *u*, passing over the peripheries of two

chain wheels which are fixed upon the axis of their respective running wheels, and the hind wheels of the boiler carriage are made to move in unison by another rod *e*, similar to that marked *f* already mentioned. The distance between the carriages is determined and preserved by means of a screw from one, working into a screw box in the other; the injurious effects of jolting, and sudden concussions by obstacles or imperfections in the railway are averted by the axles of the carriages working against plates with springs underneath them, and by providing several universal joints to those parts liable to be bent under these circumstances.



### MACNAMARA'S PATENT PAVEMENT.

A PROSPECTUS of this newly-invented Pavement has been sent to us, the engraving at the head of which appears to have been so incorrectly drawn in perspective, as to render the form of the stones, which it is intended to represent, almost incomprehensible. By cutting a few pieces of wood of the shape intended to be represented by the patentee, we were, however, much gratified in finding the contrivance to be a very clever improvement in the art of paving; at least so it appears to us, and we have accordingly given it a place in our columns, with a drawing from the blocks of wood so cut.

The stones are all made alike: Fig. 1 represents a plan of one of them, the upper and under sides are of course flat and parallel with each other; on one side two of the opposite edges are bevelled off to an angle shown, and the other side is in like manner bevelled off, but on the other two transverse edges thereof, as shown by the dotted lines between the letter *a*. By inspecting this figure it will be readily conceived that the stones, being laid together as shown at Fig. 2, will reciprocally support each other; the centre stone, marked *c*, thus rests by its two under bevils on the two upper bevils of the adjoining stones *b b*, while *c*, in like manner, supports the ends of *d d* on its other two sides;\* in this simple manner a firm bond is effected; no

\* *o o o* are grooves cut across the pavement to allow the water to run off.

stone can rise up, or be even displaced by any horizontal thrust, of a force less than is sufficient to move the whole mass of pavement together. A firm and solid pavement may, consequently, be constructed on this plan, with one third of the usual quantity of stone. It is a happy circumstance in the contrivance that stones of this figure may be sawn out of one block of stone, without any loss but the saw-dust, which must render the labour and expense of preparing them of trifling consideration; and even when they are prepared from small blocks, the expense cannot be so great as to prevent the pavement becoming an economical one, especially when the permanence of the work is taken into account. Of the superior advantages of this kind of pavement we shall, however, let the patentee speak for himself, and accordingly insert the following extracts from his Prospectus.

—"The superior advantage of the Patent Pavement will enable horses to do more work with less exertion than heretofore; prevent the numerous accidents daily occurring to horses and carriages from sudden and violent jerks, &c.

"Independent of the above considerations it causes *less noise*, produces little *dust or dirt*, (as the closeness with which the stones are placed prevents the rising of the subsoil,) requires less watering, and, its constant annoyance, mud-carting, &c.

"In point of durability it exceeds all others, by obviating the percussion arising from an uneven surface, a considerable expense will be saved; and it can be kept in perfect repair for one third the sum required in keeping up the present modes of paving.

"Arches for sewers, gas, and water pipes, are also protected and rendered more permanent, the former by the immovable surface, which prevents concussion so detrimental to arches, the latter by the stability of the pavement, as the stones cannot possibly sink to press on and injure the pipes, &c.

"This system, which is now introduced to the public, is sanctioned by many scientific men, who firmly believe it well calculated to rectify the defects so long, and so frequently complained of, a fact corroborated by the specimen in Guildford Street, Brunswick Square, (part of the Foundling Hospital estate,) where it has been *down Four Years*, without any reparation, as certified.

"It is to be observed that, although the specimen alluded to is put down with large stones, that only half (near the houses) is on the system recommended."

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## History of the Steam Engine.

### CHAPTER IV. *continued.*

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In the year 1790, Mr. J. Bramah, of Piccadilly, (author of the pamphlet addressed to Chief Justice Eyre, from which we have made copious extracts,) and Mr. Thomas Dickinson, of Bedworth Close, county of Warwick, jointly obtained a patent for three Rotative Engines.

*Fig. 1* represents the plan of one of these engines, and *Fig. 2* a section. A A and B B show the ends of two short cylinders or rings of different diameters, one placed in the centre of the other. C is

the channel or circular groove, formed between the two circles. The ends of the cylinder or ring B B, are shut up by two flat plates D D, as shown in the section; to these plates is joined an axis or spindle E E, which axis or spindle passes through the ends or caps F F, which enclose the ends of the cylinder or ring A A, and which is made air-tight by means of a stuffing box in the usual way. By this axis or spindle the cylinder or ring B B, may be turned round from without, any external power being applied for that purpose; or this axis or spindle may be applied to give motion to any other machine, when the cylinder B B is turned round by any power or force acting from within. In the cylinder or ring B B are fixed two sliders, G G, crossing each other at right angles in the centre where they are notched or half spliced, so far as to allow them to slide backwards and forwards as much, at least, as the diameter of the channel or groove C. The length of each of these sliders is equal to the diameter of the cylinder or ring B B, and one diameter of the channel or groove C, and the width is equal to the height of the channel or groove C; so that the points which perforate the extremity of the cylinder or ring B B, when they are pushed out into the channel or groove, may entirely fill the same, similar to a piston working in a common cylinder; in order that, when the cylinder B B is turned round, the channel or groove may be by that part of the slider totally swept or emptied. In this channel or groove is fixed the partition H, which fills the same in that part, and, by its being fitted against the periphery of the wheel B B, prevents the passage of any fluid that way round the channel, when the caps or ends are screwed down. On each side of the partition H is fixed a rib I I, or piece of such a shape as to perfectly fit the circle B B, one quarter of its circumference, between the dotted lines 1, 2; and the remaining part is continued in a shape inclining to the circle of the greater cylinder A A, with which it forms an easy juncture at the quartile points, 3, 4. When the cylinders B B, with the sliders, are turned round in either direction, the inclined parts of the ribs I I force the opposite end of the sliders G G, successively into their channel or groove, where they are obliged to remain during one quarter of the revolution, being kept in that position by the circular part of the rib between 1 and 2. K M are two pipes of any required diameter, which may be inserted into the channel or groove, in any direction the situation of the machine may require, between the points H 3 and H 4. The sliders are rendered sufficiently tight at their junction with the channel, by means of oakum or any other flexible material, being forced into the cavities made for that purpose at the parts L L L; and also the partition H in the same way. The cylinder or ring, B B, being thus armed with the sliders, and the caps or ends, F F, screwed on by the flanches at A A, the machine is complete and ready for action. Now, supposing that, through the pipe K a shaft of water, steam, or any other fluid, from any considerable height is admitted into the channel or groove C, it would immediately force against the slider projected in the channel as at N, and also against the fixed partition H; which partition, preventing its passage that

way to the evacuation pipe M, where the spent water is discharged, the next slider in succession has passed or covered the junction of the ascending pipe K, so that each successive slider receives the pressure before it is done acting on the former; by this means an uniform rotation is maintained in the cylinder B B, and its velocity will be equal to the descent of the water in the pipe K, and its force equal to the specific gravity of the same. Thus this machine may be worked by steam, condensed air, wind, or any other elastic or gravitating fluid, for the purpose of working mills, or any other kind of machine or engine whatsoever, they being properly connected with the axis or spindle E E; and when any power is externally applied to the said axis, which may turn the machine in any direction, it becomes a complete pump; possessing all the properties of every other sort of hydraulic engine whatsoever, by applying the pipes, K and M, accordingly; and it has also much advantage over every other kind of pump, as the fluid pumped is kept in constant motion both in the suction and ascending pipes. This machine may be fixed either in a horizontal or vertical direction.\*

It will be perceived that the machine, for which Mr. Job Rider recently obtained a patent, resembles this in principle. The point in which Mr. Rider's differs from it, is in his sliders being more in number, and, instead of crossing each other, are formed of shorter plates not reaching to the axis. The excessive friction of this machine would be a sufficient reason for its abandonment; besides which the cross sliders, G G, would in time become so worn at their ends, that the ribs, I I, would not be able to force them against that part of the cylinder opposite the projection H, so as to stop the passage of the steam.

Fig. 1 represents another plan of a Rotative Engine in the same patent, where the sliders are stationed in the periphery of the outer cylinder, and the water, steam, or other fluid, passes first into a smaller or inner cylinder, previous to its producing its effect in the channel or groove, as in the other example. A is the end of a hollow smaller cylinder, placed in the centre of the larger cylinder B; the cylinder A is fixed on an axis or spindle C, as in the section. D D is the channel or groove, formed between the outer surface of the cylinder A, and the inner surface of the cylinder B; to the cylinder A is fixed a wing or fan E, of a projection sufficient to fill and act in the channel D D as a piston, when A is turned round by the axis or spindle C, so as to sweep the contents of the channel; or, when any force is applied on one side of its surface, it will cause the cylinder A, and the axis or spindle C, to be turned round. The cylinder A is left open at both ends, which pass through the plates F F, into the caps, and is fitted water-tight in the junctions. In or about the middle of the cylinder A is a chamber or partition, which divides the upper end from the lower; H H are two sliders, stationed at opposite points in the periphery of the outer cylinder B, where there are cells projected as at I I, to receive them and allow their motion. These



**Fig 1**



**2**

sliders are moved by the small spindles K K passing through stuffing boxes in the usual way. They are ultimately opened and shut by half the rotation of the inner cylinder, by means of a wheel with an eccentric groove fixed on the axis, as L L. In this groove move two friction wheels, which being joined to the sliders by a connecting bar, the sliders H H are opened and shut, by the axis C turning round, so that one of the sliders H H is always close shut against the cylinder A, whilst the other is opening to let the wing or fan pass, which is again shut before the passive slider begins its motion. The machine being thus complete, suppose that, at a pipe O, a current of water, steam, or other fluid having force, was admitted into

the cap whilst the machine is in its present position, it would immediately fall into the upper cavity of the cylinder A, and, passing through the aperture into the channel D, would press against the wing or fan E, on the one side, and against one of the sliders H H, on the other; which slider not giving way would cause the wing or fan E to recede, and turn round the cylinder A with its axis C; which axis, turning the wheel with the groove L L, would cause the opposite slider to begin its motion; so that by the time the wing or fan E reaches the station of the slider, it is totally drawn back into its cell, so as to permit the wing or fan E to pass without interruption; and, by the continued motion of the machine, the slider is again shut, before that slider on which the fluid is pressing begins to move; so that, when the first slider, against which the water or fluid is still pressing, is opened, the pressure is then the same between the other slider and the wing or fan E; and the spent fluid between the two sliders immediately rushes through the lower aperture into the bottom of the cylinder A, and is carried off in that way to the open air: thus a uniform rotation will be maintained as in the former example.\*

This engine is remarkable for simplicity; and if a metallic packing had been at that time known, it might have approximated to a useful rotative engine. As it was, it would be impossible to make hempen packing pass over the grooves for the sliders without being speedily torn out; and also it would be very difficult, if not absolutely impossible, to keep the sliders H against the internal cylinder A, as at each stroke the sliders would rebound from it, and not being kept close by the force of the steam, as in many rotative engines, would soon become loose at the joints, and thereby become ineffective.

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### Discoveries & Processes in the Useful Arts.

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**LORD COCHRANE'S STEAM VESSELS.**—These vessels are about 150 feet in length and 25 in width in the beam, tonnage only 120. From the small size they are adapted for running in and out of creeks, and getting into shallow water, where they can throw with impunity shells into the sea-coast towns of the enemy; the draught of water is only nine feet, and when the guns are in, about ten feet. Both vessels are calculated to carry from 14 to 16 sixty-eight pounders, and probably two or three mortars. In each vessel there is a shell room, and the extraordinary strength and size of the timbers seem to justify the belief, that they are intended to be much employed in bombardment. Each vessel has two fifty horse power engines, and it is supposed that they will travel at a rate equal to the largest steam vessels. There are three small masts for sailing, but the reliance seems to be placed almost exclusively upon their steam powers. Each vessel will carry from 50 to 60 hands, the accommodations for

whom, as well as for the officers and admiral, are of a very limited description, every thing having been apparently sacrificed to the warlike and important objects in view. The paddle boxes are of very peculiar construction; that on the starboard contains a dressing room and bath for the captain, that on the larboard side is conveniently fitted up as a cook's galley or kitchen.

**NORTHERN EXPEDITION.**—A new expedition under Capt. Parry, has been resolved upon, at the earnest solicitation of that gentleman, to explore the northern hemisphere. Some small vessels or boats of a peculiar construction are to be taken out with the *Hecla*, in which it is said, the captain, with a part of the officers and men, will actually attempt to reach the North Pole, leaving the *Hecla*, in the neighbourhood of Spitzbergen.

**SOUTHERN EXPEDITION.**—The *Adventure* and *Beagle* sailed from Plymouth last month to survey the farthest coasts of South America: every thing that could contribute to their wants or comfort have been most liberally supplied them by the Admiralty, and for the furtherance of geographical and other discoveries.

**SOUND ATTENDING THE AURORA BOREALIS.**—Speaking of this phenomenon, M. Ramm states—“I believe that I have heard it repeatedly during a space of several hours, when a boy of ten or eleven years old (it was in the years 1766, 1767, or 1768) I was then crossing a meadow, near which was no forest, in winter, and saw for the first time, the sky over me glowing with the most brilliant light, playing in beautiful colours, in a manner I have never seen since. The colours shewed themselves distinctly on the plain, which was covered with snow, or hoar frost; and I heard several times a quick whispering sound simultaneously with the rays over my head. However clear this event is, and always has been in my memory, it would be unjust to expect it to be received as an apodectical truth, but should others have made similar observations, it would be important for the enquirer into the nature of the aurora borealis.—*Rammorm in Torset. March, 1825.—Phil. Mag. lxxiii. 177.*

#### TO CORRESPONDENTS.

*Our usual monthly list of New and Expired patents will be given in our next number.*

If J. S. will permit us to extract the jewels he has sent us from the mass of heterogenous matter in which they are imbedded, we shall take pleasure in presenting them to our readers.

W. H. is just received, his queries shall be inserted.

Mr. Wightman's communication has been received, and will, if possible, be inserted in our next.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

No. 84.] SATURDAY, SEPTEMBER 16, 1826. [Price 4d.

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### EXPLANATION OF LETTERS OR REFERENCES

A A, the Colonnade  
marked yellow  
B, the Bank  
C, Cornhill  
D, Cheap-side  
E, Exchange  
F, Fishmongers' Hall  
G G, Gracechurch St  
H, Bishopsgate Street  
I, Post Office  
J, Lombard Street  
K, Coleman Street  
L, Livery  
M, Mansion House  
N, New London Bridge  
O, Old London Bridge  
P, Princes Street  
Q, Fenchurch  
R, River Thames  
S S, New Street,—  
marked red  
T, Martin's Lane  
U, Upper Thames St  
V, Millers Lane  
W, London Wall  
X, Moorgate  
Y, Tottenhose Yard  
Z, Angel Court  
[unclear] Church-lane

MR. PETER JEFFERY'S PROPOSED COLONNADE  
AND NEW STREET.

## PROPOSED COLONNADE AND NEW STREET.

BY MR. PETER JEFFERY.

*To the Editor.*

SIR,

In submitting a line for an arcade or colonnade (which latter I prefer) from Bartholomew-lane to London Wall, or from Tokenhouse Yard to Moorgate, I claim an originality of idea.

The property through which I propose to have it formed, is in a very dilapidated state, and comparatively of small value, presenting a most eligible investment for capital, by making a commodious approach to the Bank of England, the Royal and Stock Exchanges, the counting-houses of the merchants and bankers, from the populous districts on the northern side of the metropolis.

To effect this desirable object I propose to form a joint stock company, the subscribers to which will have the pleasing satisfaction of seeing erected, under their own auspices, a work of great public utility, with the certainty of receiving full 10 per cent. per annum on their investment, instead of subscribing to foreign loans that may never be repaid, or sinking their monies in the mines of South America.

The necessity for having a new street from the New London Bridge to Cornhill, (as is shown in the frontispiece) is the great inconvenience and danger arising from the narrowness and steepness of Fish Street Hill, and the certainty of a great increase in the number of passengers and carriages over the new bridge when it is completed.

The vacant ground in Lombard Street, fronting the beautiful tower of St. Mary Woolnoth's church, and the certainty of obtaining from government (if not as a free gift), at a moderate price the present Post Office; and as the houses to the east of Fishmongers' Hall are to be removed, a most favourable opportunity presents itself for making the proposed street; and by removing the banking-house of Sir William Kay, Price, & Co. widen the entrance of Princes Street.

I beg to state that a plan is in contemplation for making a new street from Lothbury to Moorgate; but as it did not originate with me, I merely allude to it in order to show that, if carried into effect with the street I have suggested, a grand thoroughfare will be effected from the counties of Kent and Surrey with the great north roads.

From the state of the money market at present I anticipate a fund can be raised, sufficient to accomplish this grand undertaking, necessary for the health and comfort of the inhabitants of the first city in the world.

I have submitted my plans for the proposed street and colonnade, to the Committee of Improvement, at Guildhall, and have the satisfaction of stating that both are approved by them, and the necessity for their being undertaken admitted.

81, CHEAPSIDE,  
9th Sept. 1826.

PETER JEFFERY.

**DR. LAMB'S PATENT EXTRACTS FROM MALT & HOPS.**

MANY successive attempts have been made to prepare an extract of malt and hops, that might readily be convertible into properly tasted fresh beer, whenever required for use, and of such a condensed bulk, as to be calculated for the supply of a ship's company upon long voyages, and for exportation to other climates as an article of commerce; this desideratum appears to be now accomplished by Doctor George Augustus Lamb, (D.D.) of Rye, Sussex, whose composition for the purpose has been recently the subject of a patent: his process, as detailed in the enrolled specification, is in substance as follows.

An infusion of malt is prepared in the ordinary method of brewing; this dilute extract is then put into a boiler, and so much of the water abstracted by evaporation, as will reduce the produce of a bushel of malt, of good quality, to 23 pounds.

An extract of hops is prepared by first infusing them in the proportion of 1 lb. of hops in two gallons of water; then distilling the infusion by which an essential oil is obtained, in the proportion of about one ounce to every seventeen pounds of new hops. After this the evaporation is to be continued, and the vapour suffered to escape, until the residue shall be so reduced as to cause a loss of 35 lbs. out of every 50 lbs. weight of hops employed, leaving an extract of only 15 lbs.; to which is now to be added the essential oil obtained by distillation, in the proportion of 3 ounces to 15 lbs. of the gross extract. "The process of separating the water (after obtaining the essential oil from the hops, as before described,) may be expedited by subjecting the hops to the squeezing of a powerful press.

The two separate extracts of malt and hops may now be mixed together in a large earthen or wooden vessel, in the proportion of 3 lbs. of the extract of hops to 230 lbs. of the extract of malt, which is then to be preserved in stone jars or bottles made air-tight. When required for the making of small beer, one pound of the mixed extract is to be mixed with every gallon of water, and subjected to fermentation by adding thereto a small quantity of yeast; for table ale 1½ lb. of the mixed extract, and for strong ale 2 lbs.

If the mixed extract is destined for a long voyage, it would be better to put about 4½ lbs. of the extract of hops to 230 lbs. of the malt extract.

In this manner a beverage is produced containing the mucilage; the peculiar taste, flavour, fragrance, &c. of newly-made beer.

**YANDALL'S PATENT CALEFIER AND REFRIGERATOR.**

[We insert the annexed *Communication*, which has just come to us without signature, in the forlorn hope that the patentee will "look before he leaps," and, if not too late, keep the money left in his pocket, which it would appear he is, unwittingly perhaps, about to part with. If he employs an agent to procure his patent, it is not

possible he can be so ignorant as not to know, or if informed, that he can be so knavish, as not to tell his client, that what he considers to be "an assumed impossibility," was done and patented by Mr. Vallance many years ago; and has been adopted under endless modifications, and is now *extensively practised in a thousand manufactories*. Had Mr. Y. consulted a man of talent, knowledge, and experience, (such as Mr. Wyatt, of the Repertory, or Professor Milhington, &c.) we think he would have saved "a mint of money," and "a world of anxiety."]

—"The transference of temperature from one fluid to another by the employment of equal, or less than equal quantities of each, so that the one shall imbibe almost the entire temperature of the other, however high, or however low, is believed, by the generality of scientific and practical men, to be absolutely impossible.

"Those who are interested in the removal of the assumed impossibility, are respectfully invited to inspect the discovery\* to which this article owes its origin.

"They will then see an apparatus for heating, cooling, and condensing fluids, of great compactness, peculiar simplicity, and comparatively moderate cost, which employs equal quantities of cooling or heating fluid only; which may be so constructed as to employ less than equal quantities, and which raises or lowers temperature to almost any extent.

"It is evident that the application of such a power to steam machinery, to brewing, distilling, oil refining, dyeing, and to various other arts, must produce the most important results.

"With real satisfaction, therefore, we state that models of the apparatus are now on exhibition, from 11 until 4 o'clock, at the manufactory of Mr. W. Izod, Brazier and Coppersmith, No. 6, Red Cross Street, Mint, Borough."

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### **London Mechanics' Institution.**

On Friday, the 25th of August, the President, Dr. Birkbeck, delivered his second Lecture, *on modern Mechanical Inventions*, to a very crowded audience. He began by observing that there appeared to exist a power among the atoms of bodies which prevented their actual contact; as well as the masses of bodies notwithstanding their apparent approximation. To illustrate the fact, and to show the effect of the interposition of the air to a falling body, the Doctor employed two glass tubes, of similar dimensions, closed at both ends; one tube containing water and atmospheric air, the other tube, having been exhausted of its air, contained water alone. The former, being held in a vertical position and suddenly reversed, the water fell to the other extremity without any perceptible sound; but when the latter was reversed in like manner, a sound was produced like that of the striking of a metallic body upon the glass.

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\* Our readers may inspect a similar, if not the same discovery, in No. 57 of this Work, (Vol. III. p. 139.)

The stupendous cataract of Niagara, half a mile in breadth, and falling from a height of 140 feet upon a rocky bed, is now heard, it is said, at a distance of fifteen leagues; but, supposing the resisting medium of the atmosphere to be removed, (as in the last experiment) it is impossible to conceive the distance at which it might be heard, or the other tremendous effects that would result from the percussive of its mighty waters.

The lecturer next observed that the particles of even air, or gaseous bodies, under certain circumstances, struck with considerable force against solid matters upon which they impinged; which he proved by the loud report attending the explosion of a mixture of one volume of oxygen with two of hydrogen; the chemical union of the two gases, effected by this experiment, is also attended by another remarkable circumstance, their consolidation into water, being a two-thousandth part of their previous bulk.

It is not, however, by chemical agency alone that the particles of plastic fluids may be consolidated; in the fluid obtained by the compression of the carburetted hydrogen gas, into the portable gas reservoirs, we have an instance that their consolidation may be effected by powerful mechanical pressure. The lecturer here exhibited this remarkable fluid, and observed that its uses were not at present fully ascertained, but that it had been found an excellent solvent of the resins generally, but particularly of the elastic resin, caoutchouc, or India-rubber. To show that this fluid was a result of the condensation of bi-carburetted hydrogen gas, and that it would re-assume the gaseous form; a few drops of it were poured into a cylindrical glass jar, and shortly afterwards the liberated gas, which filled the vessel, was inflamed by a lighted taper.

The lecturer next adverted to the expansion of the gases during their combustion. Having procured some hydrogen gas by pouring dilute sulphuric acid upon zinc, one of three barrels of an electrical pistol was completely filled with the hydrogen gas, while the other two were charged with a mixture of hydrogen and atmospheric air. On applying the electrical spark to the first no explosion took place, there being no atmospheric air within it to support the combustion; but the other two, containing explosive mixtures, were successively discharged by sparks from an electrical machine, and the corks which stopped them were projected with considerable force against the ceiling of the theatre. This experiment, and several others that were made by the accomplished lecturer, clearly proved, that expansion does take place during combustion; a fact which appears to be perseveringly disregarded by persons who profess a perfect acquaintance with the subject.

The attention of the members was next directed to a beautiful and large working model of Mr. Brown's Gas Vacuum Piston Engine of one-horse power, which stood upon the floor of the theatre; and, likewise, to a large diagram of Mr. Brown's Pneumatic Engine. On referring to the latter the Doctor took occasion to state that, for this diagram, as well as for the series of drawings, (before exhibited) representing the machinery employed at the London Portable Gas

Works, the members of this Institution were indebted to the Editor of the Register of Arts and Sciences, a *Work highly deserving their perusal and attention, as it contains a greater variety of new and important mechanical Inventions and Discoveries in the Arts than can be found in any other Work, however great their pretensions, or their cost.*

The lecturer proceeded to explain the construction and operation of the machines; (*for which we must refer our readers to the 22nd number of this Work, which contains the first and fullest description given to the public through the medium of the press.*) In adverting to the model of the piston engine, the Doctor expressed his regret that it was not at that time in working order; so that he was only enabled to explain the operation of its parts, without effecting a vacuum in the cylinders; the fly wheel of the machine was accordingly turned by hand for that purpose. Had the engine been in working order, the expansion of the gas, during combustion, would have been made apparent by the flashing out of the flame above the cylinders, which would account for the extent of the vacuum effected, amounting to about four-fifths of a perfect vacuum.

### QUARTERLY MEETING,

*Of the Members of the London Mechanics' Institution.*

A QUARTERLY General Meeting of the Members of this Institution was held on Wednesday, the 6th instant, to receive the Eleventh Quarterly Report of the Committee of Managers, from which we give the following extracts, as being of general interest, and showing the progress of that Institution, which led the way to numerous useful establishments of the same nature.

—“ The period during which it (the London Mechanics' Institution) has now continued, has afforded sufficient time for diffusing a knowledge of its object; and its progress has sufficiently established its splendid, its extensive utility. All the principal objects contemplated at its commencement have, for some time, been fully realised, with the prospect of its soon becoming a still more powerful instrument for the cultivation and diffusion of useful knowledge, both in the Arts and Sciences. If any proof can really now be required, either of the benefits attained, or those which are attainable, your committee would merely refer to the evidence afforded by the number of those individuals who have continued constant attendants upon its Lectures, as well as its elementary schools; and although they regret to state, that a considerable decrease has taken place within the last three months, in the number of members which, at the close of the quarter's accounts, on the 19th of August last, was 1266, yet they feel persuaded that this proceeds, not from a depreciated estimate of the importance of the Institution, but from the operation of those calamitous circumstances which have latterly distressed and paralysed the whole community. With confidence unabated, however, your Committee look forward to the zealous co-operation of the members who have not thus been disabled; trusting that, although some even of them may have to sustain a portion of the distress inflicted by these

adverse times, they will not sacrifice the lasting benefits to be derived from this important Institution, but redouble their efforts in support of a cause completely their own: a cause which, vigorously maintained, will accomplish the unlimited extension of human knowledge, and with it secure the attainment of every great object associated with the best and most exalted interests of mankind."

The Report then proceeded minutely to detail the quarter's Cash Transactions, by which it appeared,—“That the income, and, necessarily, the expenditure, has been somewhat more limited than on former occasions: at the same time the permanent property of the Institution continues to increase in value and usefulness: for, during the quarter, presents of 51 volumes, 11 parts of volumes, and 43 pamphlets, had been added to the Library, which now consists of 2535 volumes, exclusive of pamphlets and unbound periodical works. Nor has the liberality of the members and friends of the Institution been confined to presents of books; for the apparatus department has been enriched since the last Report, by several valuable maps and drawings, and a great number of specimens of minerals."

After particularizing the various donations and names of the donors, the Committee reported, “that the progress of the pupils in the different elementary schools had been very satisfactory; and expressed the obligations of the Institution to Mr. Reynolds, Mr. John Collins, jun. and to Mr. Peter Christie; for their gratuitous instructions to their fellow members, and to Mr. Preston for his important aid to the members composing the class for Mutual Instruction in Mechanical Philosophy, who have continued their weekly meetings during the greater part of the quarter. This mode of acquiring information seems to be so acceptable to the members, and to possess so many advantages, that the Committee have resolved to continue the plan, and they have in progress arrangements for that purpose."

The Report, in allusion to the subject of Lectures, stated that, on Wednesday, the 13th instant, Mr. Thomas Hodgskin will commence a course of Lectures on the Productive Powers of Human Labour, which will occupy four successive Wednesdays.

“The course of Lectures now in progress on Modern Inventions, connected with the Arts and Manufactures of the country, by your excellent president, will occupy four or five succeeding Fridays, previous to the commencement of his intended Course on the Structure and Functions of the Human Body. The present Course on Mechanical Inventions is no less valuable for the novelty of the subjects selected, than for the interesting and eloquent manner in which they are introduced to the members. Were it not for these Lectures, a great portion of the members might never have an opportunity of witnessing some of the most ingenious applications of the principles of mechanical philosophy which have ever been devised; but your Committee consider it unnecessary to dwell upon the obligations of the institution to Dr. Birkbeck, your inestimable President, as they feel assured that there is not a member who is not fully sensible of his invaluable aid as a President, a Patron, and a Professor."

The Committee then alluded to the progress of Mechanics' Institutions in General, and to the favourable Reports which have been published of their proceedings, and concluded their Report by observing, "With documents such as have now been furnished, your Committee confidently anticipate that want of opportunity for acquiring information, and want of knowledge, will no longer be understood to imply the absence of inclination to improve, and the absence of intellectual powers; and that the general business of life will soon extensively demonstrate; how numerous are the avenues to an improved condition, which are opened to him whose faculties have been adequately exercised and enlarged."

After the Report of the Committee had been received, the Meeting made several verbal alterations in the Rules and Orders, and carried a resolution to admit the Members of Provincial Institutions, while on a visit to London to attend their Lectures.

The unanimous thanks of the Meeting were then voted to Mr. Toplis, for his excellent gratuitous Course of Lectures on Mechanics; to Mr. Ogg for his able Lectures on Geology and Mineralogy; to Messrs. Preston, Peter Christie, Reynolds, and Gollins, Jun. for their gratuitous superintendence of several of the elementary schools; to the Vice-Presidents; to George Grote, Jun. Esq., the auditor who examined the last half-year's accounts; to the retiring Committee-men for their valuable services for the past twelve months; to the members of the present Committee; and to the secretary, Mr. Christie, for his assiduity in the fulfilment of the duties of his office.

Suitable acknowledgments were made by Mr. M'William, Mr. Preston, Mr. R. Taylor, &c., after which the cordial thanks of the members were voted by acclamation to their excellent president, Dr. Birkbeck, for the deep interest he had uniformly evinced for the welfare of this and every other institution calculated to promote the happiness of the human race; and particularly for the able manner in which he had presided over the business of the evening.

Dr. Birkbeck expressed the high gratification he felt in receiving the thanks of the members on occasions like the present. To say that he valued these testimonies of their approbation was unnecessary, for he was confident they would appreciate his sense of their kindness, without such an assertion. From the commencement of the Institution, he had hoped much from its establishment,—he had minutely watched its progress, and he might say that his hopes had "grown with its growth, and strengthened with its strength." Though its numbers had somewhat declined during the last quarter no stronger proof of its stability could be given, than its having flourished in such a period of general distress and ruin. The Doctor proceeded to observe, that if he were now entitled to the good opinion of the members, he hoped hereafter to merit its continuance; and he assured them that no cause, except want of health, should prevent him from attending to their interests. The time might, however arrive, and perhaps quickly, when his services could be dispensed with; but even then he should be always on the spot as a spectator, though not in an official capacity, to witness the power and prosperity of that Institution, of which he now hoped and believed things so great.

The President's speech was received with great respect and applause, and the Meeting which was conducted with much regularity throughout, then adjourned.

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### “ECCENTRIC TURNING.”

*To the Editor.*

Sir,

A few days ago a friend put into my hands the Third Volume of your highly valuable work, which convinced me of the benefit which it rendered the mechanical and scientific world; and

also struck me with the beauty of its execution; I therefore determined upon sending to you the accompanying drawings and description of machinery for Ornamental Turning, (though it was written for another publication,) to make what use of it you may think proper. I have also sent you two blocks, on which I have cut a few specimens, and I may add that they were executed in less than four hours.

I am, Sir,

*Aulton, Yorkshire,  
August 10th, 1826.*

Your obedient Servant,  
W. E. WIGHTMAN.

Fig. 1 represents the lathe, with the cutter frame fixed in the compound sliding rest, ready for use. A the triangular bar on which the machine is mounted. B B two pillars which support the bar; the parts *b b* fix it to the lathe frame. C the left-hand head; D the pulley; E the mandril; *e* the screw on which the chucks are fixed; F the cutter frame; *f* the cutter; G two wheels which give a slow motion to the cutter frame; H the rod and handle of the slow motion; I I two heads or puppets, in which is fixed the spindle K of the cutter frame; L a bar of steel, on which the puppets are fixed, and which also fastens the cutter frame to the compound sliding rest, by passing it through a hole in the tool frame, as will be seen on reference to the figure, the part *y* removing for the purpose: M a groove turned on the edge of the cutter frame, for the string N to work on; O represents the frame for double stringing the lathe; P a moveable pulley, whereby it may be fixed perpendicularly over the cutter frame; Q a weight attached to a pulley behind the bar, for keeping the string N tight; R R R the pulley's string and weight connected with the frame O for double stringing the lathe. T the index to the division plate, S one of two screws for changing the rectangular position of the compound sliding rest to an oblique. --S, Fig. 2 and 3, represents the slide of the cutter frame; and *h*, Fig. 3, the screw whereby the slide is moved; *g* the screw for fastening the cutter.

Fig. 2 is an enlarged view of the cutter frame when removed from the rest. Fig. 3 represents the face of the cutter frame. Fig. 4 the back of it with the wheels of the hand motion.

The compound sliding rest is a machine so well known that any reference to it more than what will occur hereafter would be unnecessary.

The letters refer to the same parts in all the figures.

This machinery is intended to supersede the use of the eccentric chuck, by assuming a more natural and easy method of engraving by the tool or cutter tracing the work, instead of the article doing it that is to be ornamented. By this improvement the action of the tool is more distinctly seen than could be by the movement of the chuck, especially after a few circles have been cut; for, by their rotation, the eye (particularly of an amateur) is soon fatigued, and yet to these inconveniences a turner must continue to submit if no better method could be contrived.

The principal advantages of the present invention are the following. At a comparatively trifling expense (to the costly machinery now in use) a turner may be put into possession of an apparatus which will

answer all the purposes of eccentric and cycloidal turning, and which will, at the same time, form a complete drilling frame.

As an apparatus intended to supersede the use of the eccentric chuck it combines many advantages, amongst which three may be mentioned that are of importance. 1st,—As all patterns are worked by the divisions of the plate on the small wheel of the lathe, a much more extensive variety of circles can be obtained than could be by the divisions of the eccentric chuck. 2ndly,—By slackening the

account of its connection, (being a bad draughtsman) I am unable to send. The following description will, I hope, make its construction appear sufficiently intelligible.

The edge of the plate of the universal chuck, (the machine on which the work to be turned and ornamented is fixed, and which is a common appendage to all lathes,) I have divided into 144 equal parts, which form a wheel: and upon the face of the left-hand head of the lathe is fixed a plate, and a corresponding one on the side of the rest, through which the axis of the rod connecting the chuck and cutter frame revolves. Now, if upon the rod is fixed a wheel of 12 teeth, working on the wheel formed by the edge of the universal chuck; and if upon the other end of the rod is fixed a wheel of the same size and number, as those which work the cutter frame, and to work in one of those wheels, then it must be obvious that, by the chuck revolving once, the wheel of 12 would make 12 revolutions, which number would be given to the cutter frame, thereby tracing an accurate circle of 12 cycloids. Again, by changing the wheel of 12 to another of proper proportions of 144, a number of cycloids would be described equal to that proportion. Then by sliding the connecting rod out of gear, and moving the universal chuck any number of teeth forward or backward, the cycloids would beautifully intersect each other.

It may, perhaps, be unnecessary to add that this, and the eccentric apparatus must be worked by the hand motion of the cutter frame.

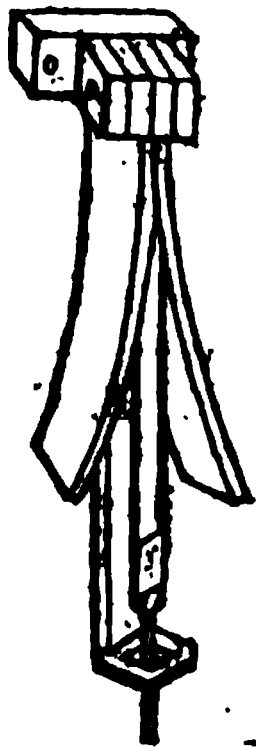
To change it into a drilling frame, all that is required consists in throwing all the wheels out of gear, and passing a string over the groove in the cutter frame to work on a pulley, P, which is fixed on the same arbor as the pulley used in double stringing a lathe. Then pass a string (which should be kept for the purpose) over the last mentioned pulley, and under the large or fly wheel of the lathe, and

after the drill has been fixed in the socket of the cutter frame, and adjusted to run true, or central, the machine will be ready for work. Now it must be clear that, by working the treadle of the lathe as in turning, a rotary motion would be given to the cutter frame; and, after the tool has been advanced to the work, then by moving the large or right angle slide of the rest, a straight line would be drilled of a length in proportion to the movement of the slide. Then change the division of the plate on the small wheel of the lathe, and if the first line was cut from the centre, then cut the next to the centre, and so on till the whole is completed, when a beautiful circle of straight lines would be cut from a centre.

Where tautology has been used it was almost unavoidable in attempting clearness of description. But I wish, in no instance, to be misunderstood; feeling the impression that the simplicity and small price of my machinery, together with the assurance that any artisan might easily construct it himself, will gain it entrance into the workshop of the operative mechanic; and will, from its combined excellencies, open a new era in the science of ornamental turning.

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"We have just been favoured with a private view of some ancient horological machines, which have been brought from Holland. Along with other curious pieces of early mechanical ingenuity, we find a clock constructed by Huygens, in the year 1658.



The mode of supporting the pendulum is shown in the accompanying figure, in which a very ingenious contrivance is resorted to for the purpose of insuring its isochronous motion. It consists of two cycloidal plates of brass, forming a curve, in which the silk line moves. It is strange that so beautiful and so scientific a contrivance should have been discontinued in the manufacture of any clock in which the pendulum of a clock is supported by a flexible cord. It may also be noticed, that the wheel-work of a time-piece is usually considered as the "measurer of time," when, in fact, it is the pendulum that performs this highly important office."—*The Atlas*.

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## EFFECTUAL MEANS OF PRESERVING WOOD.

*To the Editor.*

SIR,

AMIDST the contrariety of opinions which distract the minds of the mechanic and philosopher as to the cause of the dry rot, and the means of remedying that destructive evil in wood, I do not remember to have seen any observation upon the effect produced by the submersion of timber in the fluid that is drained from iron

pyrites, or (as it is usually termed) copperas stone liquor, previous to the chemical operation that is pursued to make the sulphate of iron from that fluid. Being the other day at the Copperas Works in the vicinity of Whitstable, in the county of Kent, I was forcibly struck with the remarkably sound state of the whole of the timber which had been lying about the premises for years, and formed part of the buildings of those works, much discoloured, either the consequence of being saturated with the copperas fluid, or from exposure to the influence of air impregnated with the steam from the standing works, or from the evaporation of the deposits, and pits of copperas stone and liquor.

Inquiring of the seafaring persons on the spot their opinion of the cause of the wood being thus secured from that destructive disease,—their unanimous opinion was, that dry rot never occurred when wood had been soaked in copperas fluid; and so deeply rooted is their conviction of the fact, as to amount to a proverb.

Inferring that some advantage might be derived by the knowledge of this circumstance to those who feel an interest in the preservation of wood from rot, I have taken the liberty of directing your attention to the subject. And, were experiments tried upon wood felled at different seasons of the year, and immersed in any of the copperas pits in the kingdom, it might set at rest speculative opinions on this matter, and conduce to important advantages to the country.

Some of the individuals with whom I entered into conversation on the subject, have made their observations on the preservative qualities of the copperas fluid on wood between 60 and 70 years.

What injury might be done to iron nails, or copper bolts, driven into the wood thus saturated, I am incapable of forming a judgment; but much of the timber at the copperas works had bolts and large nails remaining fast, which appeared only rusty and deteriorated by exposure to common atmospheric changes.

I am, Sir,

Your most obedient Servant,

J. B. C.

[That we entertain a most favourable opinion of the utility of the process recommended by our intelligent correspondent, our readers may be assured, when we acquaint them that it has, in part, formed one of our favourite schemes for some years past; but the pressure of other matters has prevented us from making the necessary experiments. Our intention was first to subject various kinds of wood to dry distillation by a slow process, and afterwards, by the aid of a Bramah's hydrostatic press, to force into and fully saturate the pores of the wood with iron or other metals in solution. The expense of the operation would not be heavy, while there is scarcely a doubt of its entirely preventing the dry rot, and, at the same time, so far extending the durability of the timber, as, ultimately, to render the process one of great economy.]—EDITOR.

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## Discoveries & Processes in the Useful Arts.

**METHOD OF PROCURING GOOD YEAST.**—Put four or five handfuls of hops in a linen bag, place it in a large pot, and pour on it boiling water, or make it boil for some time. Divide the decoction into equal parts. The first half is poured while hot into a kneading trough, in which is a little sour paste of dough. Add to it a little sugar, a few whites of eggs well beaten, and a sufficient quantity of wheat flour to form a paste of ordinary consistency; knead it well, and cover it over. When the mass is well risen it may be used for the purpose of fermenting the finest wheat paste or dough, without any fear that the bread, after baking, will retain the least sourness, because the acetic acid of the leaven has been completely decomposed in the course of the fermentation. It is probable that this would not have been the case without the sugar and the eggs. To obtain a leaven which will answer for future batches, reserve a portion of the dough, pour on it the second half of the decoction of hops, previously heated, and add the same quantity of sugar, white of eggs, and flour as before; knead the whole with a bit of the former leaven, and let it rise in the trough. Nothing but flour need afterwards be added. —*Bul. de Sciences, Sept. 1825.*

**IRON-WIRE SUSPENSION BRIDGE AT GENEVA.**—A second suspension bridge has been constructed at Geneva, of iron-wire, as successfully as the first. (see *Register of Arts*, vol. I, p. 133.) It extends in the same manner over the ditches of the fortifications; its length is 82 metres (269 feet), that however being divided into two portions by an intermediate piece of masonry. Its width is two metres (6.56 feet). It descends from the town side outwards, and also passes obliquely at an angle of  $60^{\circ}$  from the abutments, circumstances which raised the expense to 30,000 francs. The suspension cables are four in number, and contain each 135 wires running the whole length; the wires are held at the extremities in a hollow cone, and the flexure of the cables is one-twelfth of the distance between the points of attachment. The bridge, when finished, was laden for trial, with stones, timber, &c. equal in weight to that which would have been occasioned by covering it with people, which trial it bore without the slightest derangement. *Biblio. Univer.*

**POWER OF THE SUN'S RAYS.**—Mr. Mackintosh, a respectable and intelligent gentleman, who is contractor for the government works, carrying on at Stonehouse Point, near Plymouth, having descended in the diving bell with workmen, for the purpose of laying a foundation for a sea-wall, reports, that when the machine, which is provided with convex glasses in the upper part of the bell, was 25 feet under water, to his astonishment he perceived one of the workmen's caps smoking; on examining it, he found that the rays of the sun had converged through the glass, and burned a hole through the cap; also, that similar effects had, during hot weather, frequently occurred on their clothes, so that the workmen, now aware of the cause, place themselves out of the focal point.

**METALLIC HEALDS OR HEDDLES.**—A patent has been recently granted to Mr. John Osbaldeston, of Blackburn, for an improved method of making the healds or heddles of weaving looms. The healds (as our readers generally well know), are formed of two rods, one above and the other below the place, and connected together by numerous strings, through which distinct portions of the warp pass, and by means of the treadles are lifted and depressed. Instead of the numerous cords, the patentee employs very thin slips of brass placed edgewise, which are bent in the middle, and a hole made obliquely in each, so that the threads of the warp may pass through them without being drawn out of a straight line. The top and bottom rails are of wood, with a metallic groove in each, in which slide pieces of metal adapted to receive the thin blades of metal, and to be connected together by rods pressing through them.

### LIST OF NEW PATENTS, SEALED.

**FURNACES.**—To J. Barron, of Birmingham, for an apparatus for feeding fire with fuel, &c. 24th July. Six months to enrol specification.

**INK HOLDERS.**—To William Johnston, of Caroline Street, Bedford Square, for improvements in ink holders. 24th July. Two months.

**STEAM NAVIGATION.**—To William Robinson, of Craven Street, Strand, for a new method of propelling vessels by steam on canals and navigable rivers. 24th July. Two months.

**SHIP BUILDING.**—To William Parsons, of Portsmouth Dock Yard, for improvements in the building of ships calculated to lessen the dangerous effects of internal or external violence. 24th July. Six months.

**WAX AND TALLOW.**—To William Davidson, of Gallowgate, Glasgow, for some new processes for bleaching bees' wax, myrtle wax, and animal tallow. 1st August. Two months.

**TANNING.**—To J. T. Knowlton, of Trinity College, Oxford, and William Duesbury, of Buxton, Derby, for certain improvements in tanning. 1st August. Six months.

**NEW POWERED ENGINE.**—To Count Adolphe Eugene de Roon, of Priaces Street, Cassinich Square, for a new engine for communicating power. 1st August. Six months.

**GENERATION OF STEAM.**—To J. B. Wilks, of Tandridge Hall, Surrey, for improvements in producing steam for steam engines, &c. 2nd August. Six months.

**TRUCKS OR CARRIAGES.**—To L. W. Wright, of the Borough Road, Surrey, for improvements in the construction of trucks or carriages, applicable to useful purposes. 2nd August. Six months.

**FRESH SEA WATER.**—To J. Williams and John Doyle, of the Commercial Road, for an apparatus and process for separating the salt from sea water. 4th August. Six months.

**EXPLOSIVE MIXTURES.**—To Erskine Hazard, of Norfolk Street, Strand, for certain methods of preparing explosive mixtures, and employing them as a moving power to machinery. 10th August. Two months.

**METALLIC TUBES.**—To J. T. Thompson, of Long Acre, London, for improvements in making metallic tubes, and in their application to the construction of bedsteads. 17th August. Two months.

**HEATING AND COOLING FLUIDS.**—To James Randall, of Grass Street, Waterloo Road, Surrey, for an apparatus for cooling and heating fluids. 24th August. Six months.

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# REGISTER

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REDMUND'S  
PATENT IMPROVEMENTS IN SHIP BUILDING.

## REDMUND'S PATENT IMPROVEMENTS IN SHIP BUILDING,

(Proposed as a more effectual *Security from Wreck*, and to facilitate the *General Adoption of Steam Navigation*.)

**THERE** is so much merit and originality in this new mode of ship building, that we feel a degree of exultation in presenting it to the notice of our readers: a glance at the diagrams in the frontispiece must, we think, convince every practical man of the immense strength of such vessels, and of the facility with which they may be constructed. If such be the advantages attending this new mode of construction, how cheering to the mind is the reflection of the consequences that will follow from its extensive adoption! What myriads of brave lives may be saved from accidental death! what immense property be preserved from engulfment! In the short space of five months we are informed, by the ship news, that upwards of five hundred vessels with their cargoes have been entirely lost, and with them the greatest portion of their crews. Now, a large portion of these were simply stranded on banks, and went to pieces by the agitation of the waves; which, from their ordinary weak *mode* of framing, was an easy work: but, had they been built on Mr. Redmund's plan, our opinion is that they would have been proof against the buffetings of the stormy element, and the valuable lives and property have been saved: our readers will, however, judge for themselves after reading the following description and observations of the ingenious patentee, which we gather from a copy of his enrolled Specification.—

—“ The exterior of those ships which are built with circular sterns, (on the plan of Sir Robert Seppings,) presents the form of an arch in every direction in which the vessel might receive a shock. But the present system of constructing the hulls of vessels seems to render that form, so indicative of strength, of no comparative utility whatever; as an arch (*to resist shocks or violent concussions*) *should have all its parts firmly connected together, and its abutments made perfectly secure*. The present mode of framing the hulls of vessels leaves a vacancy between the ribs and frames, which said ribs or frames are not *firmly connected together, so as to unite their strength, until the planking is affixed to them*; so that, previous to planking, the hull has *no strength whatever*. Now as this is, I conceive, the foundation of the structure, I respectfully submit that, when in that state ready for planking, the vessel should be, if possible, of sufficient strength to resist all such shocks or concussions as vessels are liable to meet with; so that, when planked, she should acquire the full portion of additional strength which can be imparted to her construction by that process, and that the shocks or concussions, to which all vessels are liable, should not be received on, or affect, the tree nails or bolts, which secure the planking to the frame of the vessel. Now as the present vessels, previous to planking, are not, by their construction, *capable of supporting themselves*, and only acquire strength *by their planking being secured to the frame or timbers, by wooden tree nails or bolts*; I presume it is evident, that the greatest portion of

every violent strain, shock, or concussion, that the vessel is subject to, must in a great measure be received and sustained in some direction or other, by the aforesaid wooden *tree nails or bolts*, which have *first given strength to the fabric* by securing the frames and planking together. *The ribs or timbers not being united close together*, there seems to be nothing to prevent the greatest portion of the shocks being received by the *tree nails or bolts*; the repetition of the shocks soon works the *tree nails loose in their holes*, and the vessels then become crazy and leaky, which shows clearly how very inadequate they must be for the purpose of sustaining any lengthened continuation of such strains and concussions, as all vessels are liable to. In my construction of vessels I have no vacancy between my ribs or timbers; but I begin at the middle of the ship, and bolt each rib or frame firmly to its fellow, inserting the bolts in each that are to receive the next, as shewn in Fig. 3, which shows six of the first ribs connected together, with the heading joints always crossed, and the bolts standing out to receive the next rib; so I work right and left to the head and stern, as shown in Fig. 1, which is a longitudinal section of all the ribs or timbers, showing the bolts let in at the heads to admit of each rib being bolted close to its fellow, each requiring to have holes made in them, to receive the nut of the bolts of the previous one, as is seen in Fig. 1. My heading joints are each grooved a little way in; and a tongue or tenon of metal driven in after it is in its place, which will serve as a stop to the caulking, and give steadiness to the ends; and the tongue or tenon should enter about an inch or more into the ribs on each side. It will be requisite to have as large washers or plates under the heads of the bolts, and also under the nuts, as the size of the timbers will admit of, only the edge of the plates should not come within  $\frac{1}{4}$  or  $\frac{1}{2}$  an inch of the face of the timbers, so that, when caulked inside and out, both bolts and plates are *secured from air and water*. The holes for the bolts should be about one-fourth of the thickness, or a little more, from each edge, so that if the timber were 8 inches, the centre of the hole should be about two inches and a quarter or two inches and a half from each edge. It may be found proper in some light constructed vessels to have the bolts in the centre of the timbers; in such cases the vessels will be exceedingly strong, but will not be so *stiff* as the other way. It will be seen by Fig. 1, that all my timbers are made smaller at the upper end, and larger at the lower part next the keel; and, as every good practical shipbuilder is acquainted with the prevailing methods of striking out the timbers, to stand at any angle or inclination, I need only remark, that the angle of inclination, at which I have shown the timbers, appears to me to be the best. But if the test of experience should suggest any alteration, it is easily done by making the timbers more or less of the wedge form, as may be found best.

“The section (No. 1) also shows the timbers are of various dimensions, as it is not absolutely necessary they should be all of one size, only they should be tapered in proportion, so as to keep the proper angle; but they should be all of the same dimensions the other way, so as to produce an even surface for the planking, as at present;

and I should always keep my timbers to their fullest dimensions from outside to inside, as the more I increase the surface of my abutments, the greater the stability of the vessel; always bearing in mind that I am *constructing an arch, to be self abutted in every direction*. I can reduce the thickness of the planking, and increase the thickness of the timbers; and, by so doing, greatly increase the strength of the vessel; and as strength and stability are the principal objects I propose to obtain by my improvements, in those parts of the vessel at or near the head or stern, where the ribs form a sharper or more acute angle at the keel, as shown by Figs. 7 and 8, I would keep the line of the timbers more to the circle, to admit of the timbers which cross the keel being cut out of trees of moderate dimensions, without the grain running too much across; and to fill out the shape with what is technically termed dead wood or chocks, as shown by Figs. 7 and 8; which should be secured to the rib, and bolted to its fellow piece, which, by increasing the surface of the abutments, adds stability to the arch, and proportionate strength to the vessel.

“ If any objection should be made about the quantity of dead wood or chocks accumulating, by adhering strictly to rule laid down as relative to Figs. 7 and 8, I would wish it to be understood, that if the ribs were prepared for those parts as they are at present; only to diminish them from the top to the bottom: as before stated, and bolt them firmly together and to the keel as at present; the vessel would be infinitely stronger than by the ordinary mode, but would not, in my opinion, be of equal strength and durability as if executed agreeable to the rule laid down in Figs. 7 and 8; as on my plan, if the whole of the keel, stern post, and the dead wood, were all carried away, the frame of the vessel would remain firm and secure, and would only have lost the trifling portion of strength she had acquired from her keel and dead wood being affixed to her frame. It may be proper here to remark, that on my improved mode of ship building, every additional piece of timber affixed to it from the first rib or frame to the last plank, all and every additional piece so affixed, brings with it its proportionate addition of strength and stability to the vessel beyond its own weight. Even what is technically termed dead wood, on my principle brings its proportionate addition of strength and stability to the vessel, if it is put on and secured to each rib, and bolted to its fellow as directed.

“ The beams on which the decks lay should be secured to the sides of the vessel in the usual manner; but as room is considered a great object between decks, and the present decks, beams, and planking take up from 10 and 11 to 14, 16, and 18 inches, according to the size of the vessel, and the number of decks, &c. I propose cutting oak scantling to the size or thickness of the decks, say about 6 or 8 inches square, according to the width of the vessel, keeping the curve of the deck as much as possible, say about 7 or 8 inches in the width of about 28 or 30 feet, and the scantling about 6 or 8 inches, taking about the same quantity of timber as at present used in beams and planking. These I bolt firmly together, (see Fig. 5,) after the same manner as the ribs of the hulls, with about  $\frac{1}{2}$  or  $\frac{3}{4}$  bolts;

according to the rate or tonnage of the vessel. The scantling should be all the length across the vessel, and being bolted together as above, would be found of great strength; but to increase the strength as might be required, I would truss two together at about 6 or 8 feet apart, as in middle deck, Fig. 5, or a truss, constructed as Fig. 14, might be inserted into each scantling; or a rule joint self abutted chain, as Fig. 13, might be let into the edge of the scantling for the same purpose: and they should continue through the sides of the vessel, having a stout nut screw and plate to enable them to secure the sides firmly to the deck; thus answering a double purpose: and by having fewer or more of them, the decks may be made of any additional strength required, with an even surface underneath; yet will not take up half the space occupied by the present decks. I merely name these methods if additional strength should be required; but it is my opinion there will be sufficient strength without them. In vessels where expenses or first cost were not an object, the timbers might be prepared with a circular groove in the centre, (see Fig. 10,) in which groove a strongly-twisted rope of oakum might be put, which, being left rather large, would, when screwed up tight, form a strong and tough tongue or key, and also a stop for the caulking. The decks, if required, could be done in the same way, and they might be caulked on both sides, if requisite; and if any objection should arise about the joints of the decks running across the ship, they might board it the other way with thin boards (as see Fig. 5,) or the scantlings might run from head to stern, kept to the curve, and bolted together the same as the others; in which case it would form an arch, the abutments of which were secured; but would not be so strong as the other way. Fig. 4 shows how the timbers come to a finish at the head and circular stern of the vessel. The keel or stern post is not shown, as it is only to show how the timbers finish, and also what very short pieces may be occasionally used; as the strength of the arch does not so much depend on the length of the pieces, as on the increased surface and effectual security of the abutments. It will be understood, that spaces for port holes in ships of war can be left without materially diminishing the strength of the vessel.

“ It is supposed in this description that the keel is first laid down, as usually done, only its internal edge will be formed to the curve of the under part of the hull, exclusive of the filling out pieces or chocks alluded to in Figs. 7 and 8. The methods for laying down the lines for which curve, being familiar to every good practical shipwright, it would be superfluous to add any remarks on that head; as I do not pretend to instruct shipwrights in their business, my improvements relating only to a different mode of arranging, combining, and uniting the timbers, so as to acquire and retain the full portion of strength, stability, and capacity of resistance, which she ought to derive from her exterior presenting an arch in every direction, which latter is the case in Sir R. Seppings's improved constructions of vessels with round sterns, which I certainly conceive to be the most judicious form for a building, which is subject to receiving the most violent shocks and strains in all directions, although it will be seen my plan presents no

obstacle to the usual form of the stern being continued. My improved ship now having her decks in and firmly secured to the beams on which they rest, and also to the sides, head, and stern of the vessel, after the methods before described, I now proceed to caulk all her joints, inside and out, and her decks also, which being done, she then presents the novel sight of a ship of *great strength previous to planking*: presenting, in every assailable direction, the strength and resistance of an arch, self-supported and self-abutted in every direction; no bolt or pin, but those which secure the decks to the frame, being visible throughout her whole frame, to convey to the beholder the slightest idea of the mode by which her abutments are secured, and her frame so firmly united together—*her invisible endless chains of bolts being perfectly secured from air and water by the caulking inside and out*, the vessel itself being of course water tight every where, and of incredible strength: as the force of every shock is received on and divided amongst her numerous abutments. In this state, previous to planking, let the comparison be drawn between my improved ship, and one of the present day, previous to their being planked; one of great strength, the other of no strength at all; not being capable of supporting itself until planked. I would now remark, that as the process of planking imparts such a great degree of strength to all modern-built vessels, it will of course appear to any person that my vessel must derive a considerable *additional* increase of strength and stability by that process, as the tree nails which secure the planks to the frame cannot be disturbed by any shocks or strains the vessel may receive, the force of all outward shocks being received on and divided among her numerous abutments, and of all strains from weight or cargo on her abutments and bolts; which must be drawn apart before the tree nails can be effected, which cannot occur if they are of adequate strength in number and size in proportion to the tonnage of the vessel. I now plank her; and of course my vessel would admit of a considerable reduction in the thickness of the planks of ships of war, which may be added to the timbers; how much, I must leave to the discretion of the builders, who *will* act according to circumstances.

“ The planking would be fastened as usual with *tree nails*, as I know nothing better; and as the force of any shock will not now be felt by *them*, but received on the abutments, *they* of course will now be fully effective. Each alternate rib should be bolted to the keel, and the keelson bolted through each of the others, and through the keel also. The thickness of the bolts will be regulated by the weight and tonnage of the vessel. A vessel of 500 tons should have the six upper bolts within 6 or 8 feet of the top, in the first 16 or 18 central ribs, that is, six on each side of the vessel to each rib; and each bolt should require a force at least equal to 18 or 20 tons to draw it apart. The deck should not have less than  $\frac{1}{2}$  bolts. The whole of the bolts would be best to have strong-threaded screws, with adequate thick nuts and *plates*, as large as the timber will admit of, and in those of the decks also: should the iron be thought to affect the compass, a great number of these might be copper bolts, of equal or of adequate strength. It must be understood, I merely mention about

the number and strength of bolts that should be put in to make a firm and substantial vessel, with timbers the same size as at present, *even before it is planked*: but it is obvious that ship builders will exercise their own discretion on that head, more or less, according to circumstances; so that some vessels will be so incredibly strong, that a storm, or being driven on shore, would have no effect on them, being equally safe and secure on *land* or water; others would not perhaps build them so strong; but it is certain, that with the same quantity of timber, and a sufficiency of bolts, agreeable to the scale aforesaid, vessels may be constructed on this principle of such strength and stability, that to hear of the wreck of one of them would be quite a novelty. With timbers and bolts proportionate, there need be no limits to the *dimensions* or *strength* of vessels constructed on this plan, which is what is most wanting in steam navigation, the *desideratum* being a *larger* and *much stronger* vessel.

“ It will be seen that very strong vessels may be constructed on my principles, with the timbers running horizontally or longitudinally from head to stern, and connected together as before described. But I have described them vertically, as used at present, which I think to be the best, strongest, and simplest method of carrying my improvements into effect; as it is so *trifling a variation from the present mode*, being simply improvements on the present methods of arranging and connecting their timbers, which, if strictly adhered to and generally adopted, will put an effectual stop to the appalling annual loss of lives, treasure, and time, to which we have been so long subjected; substituting safety, certainty, and punctuality, in all the future naval and mercantile affairs of this wonderful and enterprising nation, thus keeping our own proper natural position in the new æra of enterprise opening to our view, in the general adoption of steam navigation, for all naval and commercial purposes; that I may have been the humble means of adding one link to the chain of events required to bring to perfection so desirable an object, will always be a proud and gratifying reflection to me.”

[It having been remarked to us that Mr. Redmund's method of building would cause a great additional expense; we thought it as well to make some inquiry thereon of the Patentee, notwithstanding our own opinion was very different. In reply to our inquiry, we received a very satisfactory Letter from Mr. Redmund, which we here subjoin.]—

SIR,

As I am perfectly aware of the truth of your observation, that although scientific and practical men will soon perceive that my plans cannot, when properly understood, cause but a comparatively trifling additional expense; but, as the unthinking part of the world form the far greater portion of the people, and are more apt to colour their opinions from first impressions, I perfectly agree with you that it would be most desirable to give those first impressions the stamp of correctness, I therefore hasten to reply to your request, and will make it as brief as possible.

In the first instance, I profess only to use the same quantum; or

solid contents of timber, as at present, although, ultimately, I am satisfied there will be considerably less required; and as my plan will admit of shorter pieces being used, consequently more straight timber can be used, which, being more plentiful, is considerably cheaper. As respects the number of bolts required, I inclose you a letter from a scientific and practical gentleman, in His Majesty's Dock Yard, at Woolwich, who, fully approving of my plans, took the trouble to ascertain the number of extra bolts that would be required on my plan for a ship of war of 28 guns, and 550 tons burthen. The total length used, according to the common system, is 2034 feet, being 17 cwt. 1 qr. 17 lbs.; and you will perceive, he says, that mine would require 5418 feet, being above as many again; but I will not be too exact, say 80 cwt. or 4 tons for what they now use, and say for my plans ~~three~~ times that, which will be 12 tons: that quantity would, at £28. per ton, (at which price, or less, I can have the bolts made complete,) come to £336.; being, in a vessel, whose present cost is about 16 or £18,000, only £224. extra: and it should be borne in mind that my plan supersedes the use of a great quantity of other iron work used at present. And as respects extra labour, I have already explained the *practical* details of my plans to a number of very intelligent practical shipwrights, and all of them agreed in saying there would be a considerable saving of labour and time in my plans; some even said they would not object to undertake the work at one-third less than they now have; always supposing their timbers were cut to their proper curves, &c. which of course could be done quite as well and as easily as at present. There would of course be some additional *mental* labour required in the *first* instance, in what is called their mould loft, and in making moulds, &c.

I think I have said enough to prevent false or erroneous impressions as regards first cost, and I have preferred giving the opinions of others to advancing my own; being of course an interested advocate. Although I am much gratified to be able to say that my own opinions respecting the cheapness, strength, durability, and simplicity of my plans, have hitherto proved to be in perfect unison with the opinions of all the most scientific, intelligent, and practical men to whom I have shown and explained them.

With thanks for your kind interference, I remain,

Your's, &c.

D. REDMUND, Esq.

### London Mechanics' Institution.

The unusual interest excited by the course of lectures at present being delivered at the London Mechanics' Institution by its learned president, on various modern mechanical inventions, has induced us to make a slight temporary departure from our announced intention of ceasing to give reports of the lectures, whilst our publication was brought out only once a fortnight. The measure was proposed to us by several "Constant Readers," and other correspondents, as affording a facile means of introducing into our pages a number of novel and interesting machines, and it was acceded to by us under the consideration that novel machinery, from whatever source it might be obtained, essentially accorded with the nature of our work. It has, however,

happened that the lecturer has selected subjects that have, for the most part, already appeared in this work, a circumstance which, we must confess, afforded us peculiar satisfaction, as evincing the estimation in which our humble labours have been held by the scientific and the learned. Whatever inventions may be brought forward which we have not yet noticed, will be faithfully described, with illustrative engravings; while those which have already appeared in our pages will merely be referred to. These lectures are reported in the present number; there will be two reported in the next; and in the following only one; which will complete the course of eight proposed by the lecturer. When these gleanings from the labours of others are completed, we flatter ourselves that we shall be able to conduct our readers that we have not ourselves been mere spectators, but workers in the vineyard.

### DR. BIRKBECK'S THIRD LECTURE ON MODERN MECHANICAL INVENTIONS.

EXPLOSIVE POWER.—BROWN'S GAS ENGINE.—HANCOCK'S PATENT TUBES.—BRUNEL'S GAS ENGINE.

On the first of this month Dr. Birkbeck gave his third lecture at this institution, *on modern mechanical inventions*. The learned president commenced by remarking that every discovery of explosive power had been applied by man to the extension of his energy and accommodation. He instanced the discovery of gunpowder by Friar Bacon, its application to warfare, and to the blasting of rocks: the observations of the Marquis of Worcester upon the expansive force of steam, which led to his applying it to the raising of water;—the discovery of the oxy-muriate of potash by Berthollet;—the powerful effects of the explosion of carburetted hydrogen in mines;—its successful application to the construction of a new motive power by Mr. Brown, and to other useful purposes;—lastly, the discovery of the liquefaction of gaseous fluids, by mechanical pressure, which had also recently been applied by Mr. Brunel to the production of motion.

Previous to introducing these machines to the notice of the members, the lecturer made several experiments to shew that the burning of hydrogen in Mr. Brown's engine was attended with a considerable expansion of the air within it, by which the greater part of the azote was expelled; and the descent of the caps of the cylinders preserving the vacuum thus formed, allowed the water to rise and nearly fill the cylinders. The large diagram of Mr. Brown's pneumatic engine (drawn by the Editor of this work,) was again exhibited, and the operation of the engine clearly described (which having been repeatedly explained by us in our 22nd and subsequent numbers, we shall here omit).

The lecturer next directed the attention of the audience to the large working model of Mr. Brown's piston engine, and pointed out to them several improvements it had undergone since his previous lecture, by the simplification of many of the subordinate parts; but the necessity of having a gasometer to supply the engine with sufficient gas to work with uniform effect having been overlooked, it was found necessary to postpone that exhibition till the succeeding lecture.

The tubes used by Mr. Brown for conveying the water to cool the cylinders, are of the manufacture of Mr. Hancock, of Goswell Mews,

Goswell Street), the material of them being caoutchouc, or Indian rubber; the use of which, for a variety of other purposes, the Doctor explained, and especially the convenient manner in which a tube of this material, with a stop-cock at each end, might be employed in a variety of ways as a portable syphon (Mr. Hancock's patented process for preparing the caoutchouc, and mode of working it into various articles, is given in our 33rd number, where will also be found Mackintosh's patent caoutchouc composition, &c.)

The lecturer afterwards entered into comparative estimates of the power and expense of working the steam engine (according to the average of twenty-nine experiments made in Cornwall), and the gas vacuum engine, the result of which gave a balance in favour of the latter; but of its superiority, he observed, they would be more entitled to speak, when its capability to act with effect had been shewn.

Mr. Brunel's important application of the expansive powers of the liquefiable gases was next brought under the notice of the members, by the exhibitions of some large illustrative drawings, furnished by the Editor of this work, which the Doctor proceeded to explain with his accustomed accuracy and clearness, and took occasion to mention to the members that an excellent account of this invention was given in No 65 of the Register of Arts (to which we must refer our readers). The lecturer also entered fully into the rationale of the invention, illustrating every point by the most apposite and convincing experiments.

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### DR. BIRKBECK'S FOURTH LECTURE,

*Delivered 8th of September.*

**GAS VACUUM ENGINE.—ALCOHOL.—DISTILLATION.—EVANS'S NEW PATENT DISTILLING APPARATUS.**

THE lecturer observed that he had introduced the subject of Mr. Brown's Gas Vacuum Engine again and again to their notice, until it was prepared to act with proper effect; this, he considered, was necessary to their perfect understanding of its construction and operation; it was likewise due to the ingenious inventor, who had a great deal of prejudice to contend with. A gas-holder had now been provided, so that no difficulty would be experienced for want of a sufficiency of gas to work the engine. One of Mr. Brown's sons then put the machine in action by opening the communication with the gas-holder, igniting the jets, and giving a turn or two to the fly wheel.

After having described the operation of the whole, as well as the constituent parts of this beautiful and interesting machine, the learned Doctor noticed that it was peculiarly adapted for locomotive purposes, on account of its weight being only about a fifth part of a locomotive steam engine. A diagram, representing a view of the carriage, which was lately propelled by Mr. Brown's engine up Shooter's Hill, was exhibited; after which the Doctor observed that it would also be found of advantage in the propulsion of navigable vessels, but the most effectual application of it hitherto had been for the purpose of raising water. The lecturer, having entered into some fresh calcu-

tations with a view of correcting an error in his previous Lecture, concluded his remarks by eulogizing the talents and laudable enterprising spirit of Mr. Brown with his accustomed eloquence, while his auditory evinced the most marked sympathy in the sentiments so ably expressed.

The description of Mr. Howard's Alcoholic Engine, with which the Doctor had proposed to complete his account of those machines which depend on the action of atoms, as distinguished from those which operate by the action of masses of matter, was postponed until a model was completed which he hoped shortly to have to lay before them. [*A very full descriptive account of this invention, being the only one that has yet been published, will be found in our 77th No.*]

In consequence of this disappointment the Doctor proceeded to the consideration of that singular fluid, *alcohol*, which he observed was the result of a process as curious and unfathomable as any of the hidden operations of nature. The lecturer then described the mechanical processes by which this remarkable chemical compound was obtained,—but chiefly as derived from grain; the process of malting,—the preparation of the infusion of the malt, called wort,—and the fermentation of the wort from which results alcohol in a state of great dilution with water, from whence it is afterwards separated by distillation and rectification.

We have been thus concise on the nature and preparation of alcohol, as several pages are devoted to it in our 27th number, besides descriptions of no less than eight of the most improved modern Stills in previous parts of this work.) To explain an improved mode of conducting the process of fermentation in vessels closed air-tight, a diagram, representing Madame Gervais' invention for this purpose was introduced and explained. [*For a full description of this Invention, with an engraved representation, we refer our readers to our 43rd Number, under the head Deurbroucq and Nichols' Patent, the invention being foreign.*]

The Doctor then noticed several curious modes of distillation adopted by the French and Scotch distillers, and in particular that of Count Chaptal, which appeared to him the most perfect of the former. A model of Mr. Evans's admirable apparatus was next introduced to the notice of the members in terms of high commendation, the operation of which the Lecturer rather briefly described. [*Having ourselves given a full account of this valuable Invention, together with an engraving, shewing the whole of the interesting and novel process, on the week previous to this Lecture, in our 83d Number: we refer our readers to it for all the details, and the ingenious patentee's views on the subject.*]

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### DR. BIRKBECK'S FIFTH LECTURE,

*Delivered 15th of September.*

HERBERT'S STILL.—RUSSELL'S ALARUM.—SODA WATER MACHINE.—HYDRO-PNEUMATIC LIQUOR COCKS.—DARNELL'S WATER VALVE.—STREAM METER.—NATURAL AND BOILING FOUNTAINS.—DARWIN'S THEORY OF THE EARTH.

PREVIOUS to entering upon the subject of his present lecture, the Doctor informed the members, that Mr. Howard's engine, being

still is too unfinished a state for acting, and the silk machinery which he had announced his intention of describing not being in readiness for exhibition, he should proceed to the consideration of other inventions which had some relation to those already discoursed upon.


Having in his last lecture exhibited to the members Mr. Evans's ingenious distilling apparatus, he had now to offer to their consideration another apparatus of a very peculiar construction, invented by Mr. Hebert, who had furnished a large diagram for the purpose of illustrating it to the members; which was then placed before them. By this arrangement they would perceive that a constant uniform motion was given to the liquid, but by a method totally different to that described in the last lecture. In this, the still was a fixture; and the liquid spread itself in a very thin expansive sheet over the exterior surface of a large hollow cone of copper, constantly descending by its own gravity; and the fire being situated within this cone, caused a rapid evaporation to take place over its extended surface; while the less volatile portion of the wash, consisting chiefly of water and extractive matter, was constantly running off through an aperture at the bottom of the still. By this arrangement, therefore, the necessity of stopping the process to charge or discharge the still, was entirely superseded, the operation going on *continually*, or as long as the wash or wine was supplied to the reservoir. The wash is introduced to the still by a pipe between that and the reservoir, and by means of a stop cock, the quantity of liquor to be discharged upon the cone is regulated at pleasure. The vapour given off ascends between the still and an external casing, and passing along the neck, enters a convoluted tube placed within the wash reservoir; the wash in this vessel being of a lower temperature, causes a portion of the vapour to condense and fall into a recipient beneath, where also the uncondensed portion is received, previous to entering into the principal refrigeratory; the lecturer considered this part of the apparatus (which we have not room to describe) to be a decided improvement upon the arrangements in other refrigeratories, and having explained some other contrivances introduced by the inventor, he eulogized the apparatus as being for the most part of "perfect originality," and as "calculated to lead to important consequences." [A full description, with engravings of this invention is given in No. 69 of this work, where is also shewn its peculiar adaption to other manufacturing processes besides that of distillation.]\*

To explain the principle and mode of action of Mr. Wm. Russell's (of St. John Street) improved fire alarm, the Doctor employed an apparatus commonly called a pulse glass, which consists of two small bulbs containing some coloured liquid, which are hermetically closed, and have a tube of communication between them, through which the liquid flows from one bulb to the other. On the applica-

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\* Since the publication of the above-mentioned paper some improvements upon it have been suggested by the inventor.

tion of the natural heat of the hand, or by gently breathing upon that bulb which contains the liquid, the air within it rapidly expands, and drives the liquid before it into the opposite bulb, and as the air continues to bubble up through the liquid, resembles a real ebullition. When these bulbs are equipoised upon an axis placed midway between them, it is obvious that the liquid flowing into either bulb will cause it to preponderate. A model of Mr. Russell's improved alarm was now exhibited, which being a very interesting and useful contrivance, we here annex a sectional view of its principal acting parts, observing by the way, that these are made of various dimensions,



and are sometimes put into elegant cases, resembling table clocks. *a* is one of the glass bulbs containing the liquid, *b* the empty bulb, both being enclosed in a cavity cut in a block of wood, except a portion of *a*, which projects a little outward; *c* is the centre of the motion or fulcrum, made in an upright standard, *d* the stand; *e* is a long mortised lever, containing four leaden balls, so placed over the fulcrum as to rest in equilibrio.

Now when heat is applied to the bulb *a*, the air above the surface of the liquid rapidly expands, and drives it into *b*; the weight being thus increased on that side, causes the lever to descend in the line *f* while the leaden balls at the same instant rolling down the inclined plane, accelerates the descent of the lever, and imparts to it a considerable degree of force; which it is evident may be extended indefinitely, by lengthening the lever, or increasing the number of rolling weights. As motion is thus produced, attended with great power, its application to the ringing of a bell, or any number of them, or the firing of a gun may be easily understood; all that is required being a crank (which Mr. Russell usually fixes to the fulcrum) and wires to connect them. Mr. Russell likewise occasionally attaches a water pipe and stop cock to the fulcrum of the lever, the plug of which it opens as it turns round, when the floor beneath becomes deluged with water.

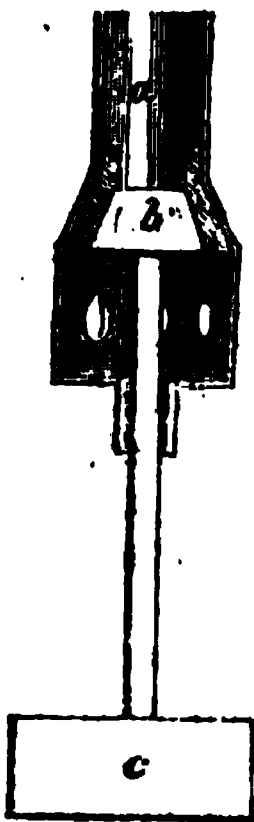
Having described the preceding invention, and put in action several modifications of it, the Doctor mentioned some other contrivances for the same purpose; among them was one proposed by Sir William Congreve, which we must not pass by without notice. Two flat pieces of metal were suspended by a single thread to opposite corners of a room, and the metal plates were joined by a

species of cement, which would melt at a low temperature ; at a slight increase of heat, therefore, the metal plates fall asunder, and put in motion an alarm.

The next subject introduced by the lecturer, was another illustration of the condensation of matter in a gaseous form. For this purpose, some diagrams of the soda-water apparatus, made by Mr. Russel, was exhibited, and its construction and operation clearly explained. As our limits do not enable us to include a description of this apparatus in our report, we purpose, at an early opportunity, to introduce the subject in a separate paper.

Mr. Russel's patent air vent, as applied to his improved liquor cocks, were next exhibited, and their useful properties proved, by some well conducted and convincing experiments ; but as *these very complete inventions have already been fully described by us, with illustrated engravings, in our 20th and 23rd numbers*, we must pass them over here without further notice.

As connected with the preceding inventions, the lecturer introduced a simple water-valve, by a Mr. Darnall, of Pentonville, as a substitute for the common ball-cock used for regulating the height of liquids in reservoirs, with which some experiments were made to shew its mode of action. The annexed diagram will explain its construction : *a* is the supply pipe, *b* the valve (shut), *c* a float, connected to the valve by an upright spindle. When the water is drawn off, the float sinks, and the valve descends from its seat into the chamber beneath, allowing the water to pour through the apertures shewn, into the reservoir ; the float, as it rises again with the water in the reservoir, closes the valve, and shuts off the supply of water when it has attained its proper elevation.



An instrument for determining the expansive force of steam under different temperatures, was next brought under the notice of the audience, and its important uses shewn by experiment. The annexed figure gives a sectional representation of it. At the bottom, of a strong spherical vessel of brass, is placed a quantity of

mercury, sufficient to fill the long vertical glass tube above; over the mercury is the water to be converted into steam, by a spirit lamp placed beneath. The long tube is submerged in the fluid, so as to nearly touch the bottom; on one side of this tube a thermometer is fixed, in an inclined position, its bulb projecting towards the centre of the vessel. On the application of heat, the water was converted into steam, which by its expansive force pressed upon the surface of the mercury, and impelled it up the long tube, where its pressure was noted upon a graduated scale; at the same time, the height of the mercury in the thermometer shewed the temperature of the steam. From this experiment, the Doctor took occasion to notice the superiority of high pressure engines over those of low pressure; for steam, at  $212^{\circ}$ , was only equal to the pressure of one atmosphere; while steam at only  $312^{\circ}$  exerted a force equal to  $5\frac{1}{2}$  atmospheres. These important facts being satisfactorily demonstrated, the stop cock of the instrument was opened, when the hot water and steam was impelled through its orifice to a con-



siderable height, affording a lively illustration of the steam fountain of De Caus, of which a description, with an engraving, may be seen in our 63rd number.

After the exhibition of this artificial fountain, the lecturer stated that precisely the same effects, and proceeding from similar causes, occurred in nature; he instanced, in particular, the boiling fountains in Iceland, called the geysers; a splendid transparency of one of these (the New Geyser), executed in the most masterly style by a Mr. Pearsall, was then exhibited. In the back ground, at a considerable distance, was seen Mount Hecla, vomiting forth its fires, affording a beautiful and sublime contrast to the magnificent boiling fountain in the foreground. In alluding to Hecla, the Doctor humorously observed, that the painter had, by the magic of his pencil, melted all the snow which covered its summit, notwithstanding all the fires of the mountain for ages had been unequal to the accomplishment. Having described these wonders of nature, with his accustomed eloquence, and illustrated their secret, or rather hidden, operation, by an imaginary section of the earth at their bases, the lecturer proceeded to descant upon Dr. Darwin's theory of the earth, a beautiful diagram of which, representing an imaginary section of the earth (painted also by Mr. Pearsall, with admirable spirit), was then exhibited. The centre, and greater portion of the surrounding parts, supposed to be granite, was represented as in a state of fusion, from internal fires, and communicating with the several

volcanoes, boiling springs, &c. on its surface, by which Dr. Darwin ingeniously endeavoured to account for all these wonderful phenomena. The Doctor then stated the arguments against this theory, and mentioned some experiments of Mr. Perkins on the compressibility of water, and the opinion of that gentleman, that water, at the depth of 500 fathoms from the earth's surface, is compressed into a solid form.

#### TO CORRESPONDENTS.

We are really sorry to have disappointed Tipton Mechanic, and have to assure him that we have not been on the south side of the Thames these three months past; when we have occasion to go near the place in question, his wishes will be attended to.—We can gain no information of the construction of the trap he mentions, until the society shall have published their next volume.—The particles of water in high pressure steam being more finely divided than in low pressure, we suspect the latter would not answer well, or so well as the former: T. M.'s query on this subject will be inserted in our next.

Our excellent friend P. B. P. will excuse our postponing his valuable communications until after Dr. Birkbeck's present course of lectures have been inserted.

H. L. is intended for early insertion.

The conduct of our correspondents who call themselves "THE PROPRIETORS OF YANDALL'S CALORIMETER AND REFRIGERATOR" towards us, reminds us of the folly and ingratitude of little peevish children sometimes towards their mothers, whom they will slap and scratch, while they are receiving from them support and protection. In our last number we inserted a choice article, received from the above-mentioned proprietors, which they had the impertinence to write as if emanating from the pen of the editor. The paper in question contained, as our readers will recollect, a puffing notice of a pretended new discovery, which new discovery was so extraordinary and marvellous that scientific and practical men had hitherto deemed it to be an "absolute impossibility." The paper went on to state, that this "assumed impossibility" had been effected by Mr. Yandall by a very simple apparatus; and concluded by inviting our readers to witness the wonder-working machine in operation. In thus attempting to usurp our high prerogative, we might justly have been incensed: especially as their treason was accompanied with a wicked attempt to make us tell lies for them; but such is our over-indulgent parental heart, that we were contented in giving them simply a little wholesome advice. Accordingly we told them that the "assumed impossibility" had been discovered long ago, and that it was now practised in a thousand manufactories; and recommended their inquiring into what had been previously done in the same way, before they wasted their money in completing their proposed patent, which was only sealed a week or two before. In return for all this kindness and condescension on our part, the aforesaid proprietors have sent us a highly calumnious letter, in which they are not content with scratching and back-biting, but the wicked partridges threaten to batter us with the ponderous weapons of the law; (dreadful alternative) we do not in our present number recant all that we have before stated respecting their wonderful discovery. Now on this, our recantation, we claim a demurrer, until these little workmen of impossibilities shall have informed us whether they meant to calify or refrigerate us, for we really cannot discover any alteration in our temperature.

We refer W. B. to page 202 of the present number.

Philanthropos is intended for early insertion.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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**FANSHAWE'S PATENT MACHINE FOR SPINNING,  
DOUBLING, & THROWING SILK.**

**London Mechanics' Institution.****DR. BIRKBECK'S SIXTH LECTURE OF MODERN  
MECHANICAL INVENTIONS.**

**THE HISTORY OF THE MANUFACTURE OF SILK—THE PROCESSES OF REELING AND  
THROWING—OF WATERING AND EMBOSSED :**

**including a description of**

**FANSHAWE'S NEW PATENT MACHINERY FOR SPINNING, DOUBLING, AND  
THROWING SILK, AND OTHER FIBROUS SUBSTANCES.**

THIS lecture was rendered unusually interesting by the complete preparations that had been made for illustrating the history of the manufacture of silk in its various branches, except that of weaving, which had been already so ably treated by Dr. Birkbeck in a previous lecture on the 9th of June (*detailed in our 78th number*). For this purpose the large platform of the theatre was crowded with numerous machines ; and it was most gratifying to trace the astonishing improvements that have been made of late years upon the rude and ineffective apparatus of our ancestors. Among the various contrivances, the most conspicuous and commanding was a vertical swift, of no less than eight feet in diameter, employed for winding off the skeins of the lofty Turk ; but the most interesting to mechanics was the highly improved newly-patented machinery of Mr. Fanshawe, for spinning, doubling, and throwing, by one operation ; some diagrams in explanation of which we have the satisfaction of presenting to our readers in the frontispiece to our present number, reserving a description of it until we come to that part of the lecture wherein the president introduced it to the notice of the members.

It is a matter of regret to us, that our confined limits prevent us from giving a verbatim report of the introductory argumentative remarks of the lecturer, the object of which was to demonstrate the great advantages that result to both nations and individuals from the employment of machinery to facilitate and increase the productive powers of human labour. He then adverted to the clothing used in the earliest ages, and amongst savages, consisting chiefly of the skins of animals ; and afterwards to the cotton and woollen fabrics of the civilized world. With respect to silk, its earliest employment as a covering to the body was unknown, but it was used in China, many centuries before the christian era, and the manufacture imported from thence to Greece and Rome. The Romans call it *sericum*, from *Serica*, a part of Scythia, from whence it was obtained. The name given to the silk-worm was *ser*, and from thence, probably, the name applied to the country, *Serica*.

Dr. Birkbeck proceeded to give an historical sketch of the introduction of the manufacture of silk into the western world ; from China and Persia to Thebes, Corinth, and, finally, to its establishment in Sicily and Calabria (for which see Register of Arts, vol 1. p. 226). From these countries it was, in the fifteenth century, introduced into France, and extended itself into England about the year 1620, where it was prosecuted with success by a company of silk-women. In 1628 the incorporated throwsters employed 40,000

hands in the manufacture of silk; but the greatest improvement experienced in the silk trade of England, originated in the revocation of the edict of Nantes, in 1685.

The beautiful thread of the silk-worm is produced from a substance of a semi-fluid and gummy nature, secreted in two tubes about ten inches in length wound round the intestines of the animal; it is drawn out of them (by a species of mechanism similar to that used in wire-drawing) through three or four minute perforations, the threads being so exceedingly delicate as to be almost invisible; these, by a circular motion for several days, the silk-worm winds round its own body: and forms the *cocoon*. This has been called by Gibbon its "*golden tomb*;" it might, however, with more propriety, be termed the cradle of the future moth: as it defends it from injury during the period of its transformation; when that is completed the new butterfly would gnaw its way through the cocoon, and take wing, but by the interference of man, that which was intended as its protection against injury, is the cause of its destruction. About ten days after the cocoons have been formed, they are collected, and exposed to the influence of heat in ovens, which destroys the animal and preserves the silk. After this the cultivators bring the cocoons to market and dispose of them to those whose business it is to wind or reel it. The first process is to steep them in warm water, which dissolves a portion of the glutinous substance that surrounds them. The doctor here exhibited a cauldron and a whisk, both of which had been in use in Italy, having been brought from Milan, and lent to the Institution, by Mr. Gibson, who had also kindly furnished the cocoons then on the table. The process of reeling the raw silk is as follows:—the water in the cauldron is brought to nearly a boiling heat, when a handful of cocoons is thrown into it, which being very briskly agitated by the whisk, causes the loose filaments or threads to attach themselves to it; they are then taken up by the attendant girl, who puts three or four of them together, and commences the task of reeling. The dexterity with which this is done by the girls (*fileuses*) of Italy, is truly surprising; for, while the reel is moving, the moment they see that a fibre is broken, or wound off, with a sudden jerk of the arm they throw forward another filament of a cocoon (of which they have always a quantity ready on their arms), which being drawn into the current of air, produced by the velocity of the reel, readily attaches itself to the broken thread, and thus instantly repairs the fracture.

From a calculation made by Mr. Blumenbach, it appears that it would take 2160 threads of silk from a cocoon laid side by side to form a breadth of one inch: but the lecturer was of opinion, that that number might, at least, be doubled.\* A variety of specimens of reeled silk was then exhibited, composed of four, eight, sixteen, and up to 96 threads, as originally taken from the cocoon; from which it was evident that Blumenbach's estimate was far below the real number of threads to an inch. A drawing of an improved reeling

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\* We recollect reading some English author on the subject, who states that the single filament of a cocoon would reach six miles.—Ed.

machine was then exhibited, by which any number of threads might be twisted together into one thread, or into several threads.

Some of the earliest modes of reeling silk were then explained by the Lecturer, by reference to several very simple machines; after which an old man showed the members the manner in which they were employed, by reeling portions of silk upon each of them. By these processes only a single bobbin was wound at a time, but at the present day it would be considered idle work by a reeler to employ himself in that manner. It was only thirty years ago that a mechanic of Spitalfields ventured to make an improvement upon the miserable machines then in use, he contrived an apparatus which has since been called the four-swift machine; but no sooner was this improvement introduced, than the wise men of Spitalfields, fearing that it would reel so fast as to leave them nothing to do, sought to destroy it. Nevertheless, improvements proceeded, and reels with six and eight swifts were employed, when it was likewise discovered that a man with such reels could earn more money by being paid at the rate of two-pence for work, which before was paid for at the rate of ten-pence. At the present day no less than twenty threads are reeled at once by a single machine. A Spitalfields reeler put a four-swift machine in action, while its operation was explained by the Lecturer, and particularly the contrivance by which the reeler was enabled to stop one swift when a thread broke, and join it, while the other swifts continued to revolve.

The large reel of eight feet in diameter was now referred to by the Lecturer; machines of such great dimensions being requisite to wind the Turkey silk, called *brutia*, a skein of which, about 24 feet in circumference, was wound upon it. What, but the pride of the Mussulman, could induce him to make skeins of such a prodigious length, the Doctor was at a loss to imagine: the inhabitants of Bengal were satisfied with skeins of two feet in diameter; one of which was wound upon a reel, and fixed in the same frame as the Turkish. Both were put in action by the same movement, and the mode of winding them off into bobbins, according to the ordinary method shown.

A very important improvement has, however, been made by Mr. Fanshawe, in the art of winding silk, which we hope to have the means of laying before the public as soon as the patents are completed.

After silk has been *reeled* and *wound*, the next operations are *spinning* and *throwing*, which may be performed separately or at the same time, as was the case in Mr. Fanshawe's improved machinery which he would presently describe. Before which, however, the Lecturer observed that the art of throwing silk was first introduced into this country by Mr. John Lombe, in 1719, who, with considerable ingenuity and at the risk of his life, succeeded in taking a plan of a throwing machine, in Sardinia, and on his return established a mill at Derby for conducting that operation; which had, prior to the above-mentioned date, been kept a profound secret by the foreign manufacturers. From the great expense incurred in establishing the mills at Derby, application was made to parliament to extend the

term of the patent granted to Mr. Lombe, but the legislature wisely granted him the sum of £14,000 in lieu of the extension of patent right, and upon condition that he deposited in the Tower of London a complete working model of the machine, where it now remains. Since that period many improvements have been successively made, but they were of minor importance when compared with the valuable machine before them, invented by Mr. Fanshawe. The Doctor took this occasion of stating that the audience were indebted to Mr. Fanshawe for the greater portion of the machines introduced to their notice that evening, and that, from the mechanical talents evinced by that gentleman in his improved machinery, the members might congratulate themselves in having chosen him as one of their committees. The Lecturer then explained the operation of the ingenious machine exhibited, which, being put in motion, was so contrived as to show the different methods of making singles, two-thread tram, 3-thread tram, bergam, 2-thread organzine, 2-thread sewing silk, 3-thread organzine, and 3-cord sewings, all of which were worked at the same time, the machines having been previously arranged for that purpose, there being two spindles of each sort. The simple process of throwing each spindle out of gear was then shown to the audience, which enables the person who attends to the machine to stop any particular thread which may require alteration without interfering with the rest. All these arrangements were exhibited in one model on a small scale; but, in a manufactory of ordinary extent, it would be necessary to have a considerable quantity, and each machine separately adapted to the sort of work required. The velocity of the movements of this machine, and the effects of its operations excited no less surprise than admiration in the audience. A few years ago 1100 turns in a minute was considered a great speed; but now 2000 turns is common; and in Mr. Fanshawe's machine we have been informed, 4000 turns in a minute may be given without injury to the work.

We must here make a digression from the regular course of the lecture to describe more particularly the construction of the apparatus just mentioned, with reference to the diagrams in our frontispiece; in which the acting parts are shewn as respects a single operation, and not a series of them, which would tend to confuse the reader instead of informing him.

*Fanshawe's\* Patent Machine for Spinning, Doubling, and Throwing Silk, and other fibrous substances.*

Fig. 1 is an end view of the throwing machine. A A is the top of the frame; B the bobbin; C the top spindle; D the board which supports the spindle; E the pulley which gives motion to the set of spindles; F is the flyer to the top spindle; G the lever, which throws the pulley in and out of gear; H the lever pin or centre, in which it works; I the flyer of the bottom spindles J; K is a fluted roller, which propels the drawing roller L, and gives out the thread to be thrown by the spindle C.

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\* Mr. Fanshawe, of No. 11, Addle Street, Aldermanbury.

The silk, after being wound on the bobbins P, are twisted by the revolving spindles J, which are driven by the band M; the threads *g g* pass separately through the eyes *v*, and are united at *t*, go over the glass rod *u*, round the roller L, through the eye *h*, and are then received upon the bobbin B, the twist being effected by the revolving spindle O, which is driven by the band *f*.

Fig. 2 is a bird's-eye view of the machine; the same letters referring to similar parts. R is a bevelled toothed wheel (not shewn in Fig. 1), which drives the shaft Q, and gives motion to the rollers K; and at the other end by the bevil gear N, which is connected by a rod to the motion board that draws the bobbin backward and forward, to spread the thread uniformly over its surface.

Fig. 3 is a front view of the machine, for making 3 thread organzine, or sewings, the parts having been already described above, except the bobbins *o o*, which are shown in dotted lines, and are to be used in case tram is required to be made, instead of organzine. T is a catch to retain the lever G (Fig. 1) in its place, when the bobbins are thrown in or out of gear.

Fig. 5 represents the end of the bobbin *b*, which is kept in its place by the small lever *w*, which lever is fastened on to the motion board *s*.

Fig. 6 is a sectional view of Fig. 5.

Fig. 7 is the spindle J, as seen in Figs. 1 and 3, I being a fixed flyer.

Fig. 8 is a view of the opposite side of the pulley E to that shewn in Fig. 1.

Fig. 9 is an edge view of the pulley E and the lever G, as described in Fig. 1.

The advantages gained by this machine are, 1st, The throwing of organzine by one process, instead of the three separate processes as at present practised; the spinning by one machine, doubling the threads by another, and throwing by a third. 2dly, In the very great increase of speed which can be obtained. 3dly, In the easy manner in which the machine can be altered to singles, tram, organzine, sewings, or any other description of silk. 4thly, In the saving of labour, from the great quantity of spindles that can be attended to by one hand. 5thly, In the little experience required to enable "a hand" to attend the work, thereby obviating the greatest expense in throwing ("mill hands.")

After having described Mr. Fanshawe's Throwing Machine, the Lecturer observed, that when the raw silk had been reeled and wound, it was again wound into suitable hanks for dyeing; after which it was wound again, previous to its being made into warps for weaving. The Doctor then stated, that having already explained the operation of weaving in a previous lecture, he would proceed to show some of the numerous uses to which silk was applied; and he had one of a very novel description to notice, which had been proposed by a Mr. Burnet, who was president of the Devonport and Stonehouse Mechanics' Institution. That gentleman had, in a somewhat eccentric publication, entitled, "A Word to the Members of

*Mechanics' Institutions*," of which he was the author, strenuously recommended the employment of silk for the covers of books, instead of leather, and had set the example himself, by publishing the whole of his edition of his "Word" in silk covers of an ornamental description, his object being to relieve the distress in the silk trade, which now pressed upon them with so much severity.

The lecturer having noticed the great variety of elegant patterns that were produced in the loom, as was the case with those forming the covers of Mr. Burnet's "Word," took that occasion of submitting to the inspection of the audience another and much simpler mode than that of weaving, for producing changes and elegant designs upon the surface of silk; the first he had to exhibit to them was the process for producing that waved appearance called *watering*, which was effected by simply laying two pieces of silk lengthwise, one upon the other, and thus circumstanced, passing them between two metallic cylindrical rollers, one of the rollers being hollow, and containing in its cavity a hot iron. The effect thus produced is ingeniously accounted for by Mr. Fanshawe, by the unequal pressure given to the individual fibres of the silk where they cross one another, the increased pressure producing a polish or gloss, or a wavy appearance: but were it possible that the longitudinal fibres of one piece of silk could be made to lie parallel and between the corresponding fibres of the opposite piece of silk, no such effect would take place. Mr. Fanshawe, to whom the watering machine belonged, then passed several pieces of plain silk between the rollers, when the wavy appearance was immediately produced upon its surface.

The other process which the Lecturer had alluded to, as a simple means of producing various elegant patterns upon plain silk, was that termed *embossing*. This operation is performed also by passing the silk between two rollers, one of them being heated: but the surfaces of these rollers are not plain; the pattern in one of them being sunk (*i. e.* engraved in the manner of dyes,) and in the other it was raised in relief, so that the eminences in one roller fit into the cavities of the other; and if we recollect rightly one roller was made of brass and the other of steel. The engraving, which was very tastefully and ably executed by Mr. Fanshawe himself, afforded a remarkable proof of the versatility of that gentleman's talents. Some pieces of plain ribbon were passed between the rollers, by which simple operation they were instantly converted into *embossed* ribbons, being covered with a superb flowered pattern in bold relief, and possessing in our opinion a beauty far excelling the finest damask or embroidered silk.

The president then made some observations to show the inconvenience which resulted from the obstinacy with which the manufacturers in different countries adhered to the size of their reels, which were of all possible dimensions; as well as in their weights for ascertaining the value of their hanks and skeins. Astronomers, too, who were, certainly, a more *sublime* set of men, than the reelers, were equally obstinate and inconsistent, for they could not be

brought to agree in the selection of some particular spot of the earth's surface, to fix a universal meridian: similar absurdities were likewise persisted in by the cotton and woollen trades. With the view of establishing some general standard for measure and weight in the silk trade, the lecturer stated that Mr. Fanshawe had proposed, that the *skein* should uniformly consist of 800 turns of a reel a yard and a quarter in circumference, making 1000 yards, and that ten such skeins should make one *hank*: an arrangement which would tend greatly to the convenience of the silk trade. Another great advantage would result from the adoption of Mr. Fanshawe's proposition; for the manufacturers and dealers would then be able to determine instantly the relative fineness of any particular sample of silk, by simply weighing a hank, the length of it being determined and known. The method resorted to in the trade at present is very troublesome; they have to reel off a given portion 400 turns, which they weigh with weights called deniers; then 20 of these deniers is equal to 16½ grains, in which ratio they have to calculate to bring the deniers into common weights.

The lecturer concluded his very interesting lecture, by a rapid review of the circumstances under which the silk manufacture had been extended throughout Europe, and the western world; the leading occurrences of which were the sanguinary crusades to the Holy-Land, and the folly and fanaticism which dictated the revolution of the edict of Nantes. The absurd impediments which had, until lately, existed, being removed, the British artizan might take his skill and his tools to whatever part of the world he pleased. The president of the Board of Trade, following the dictates of a great and statesman-like mind, had determined that this trade should be free, the beneficial effects of which were already manifesting themselves by rapid improvements in our manufacture, so that there was every probability of our soon being enabled to compete with the best productions of Genoa or Lyons. It was the wisest policy of governments with respect to trade, *to let it alone*. When the French minister, Colbert, inquired the opinion of the merchants as to the policy of certain measures which he had proposed for their advantage, their sensible reply was—"*laissez nous faire*." The prosperity of a nation is augmented by the greatness of those which surround it; and by the unrestricted intercourse of the inhabitants; the jealousies and contentions created by the arbitrary geographical divisions of the earth, will be gradually extinguished, and nations will become linked together in the great brotherhood of man."

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## DR. BIRKBECK'S SEVENTH LECTURE.

STEAM ENGINE BOILERS.—HOWARD'S ENGINE.—BLAKEY'S BOILER.—WOODLEY'S BOILER.—DR. ALBAN'S, M'CURDY'S, AND PERKINS'S STEAM GENERATORS.—BURNING OF SMOKE.—ATKINS' AND MARRIOTT'S PATENT STOVES.—AYLIFFE'S CHIMNEY COWL.—YARDLEY'S BONE GLUE APPARATUS.—GORDON'S LOCOMOTIVE CARRIAGE.—PALMER'S SUSPENSION RAILWAY.—ROPE ROAD.—WAY-WISER.—GLASS GRINDING MACHINE.—CLOCK-MAKING.—DYER'S AND

M'DOUGAL'S MOVEMENTS.—SHELDRAKE'S CLAIMS.—DORING THE BATH.—HEBERT'S IMPROVED APPARATUS FOR THE PURPOSE.—RUSSELL'S FIRE-EXTINGUISHING PUMP.

IN the construction of those engines which are employed as prime movers, it had always been a desideratum among mechanics to diminish their bulk and increase their effectiveness. In the steam engine, the principal inconvenience was the cumbersome boiler; yet however incommodious this might be in a manufactory, its employment in navigation was a very serious disadvantage on account of the great space it occupied. Many had been the attempts to reduce its dimensions, and to lessen the consumption of the fuel required; and recently several ingenious individuals had endeavoured to dispense entirely with the use of steam, and to apply the expansive force of other aeriform fluids, as a substitute. Thus Mr. Brown had done in his *hydrogen-gas engine*, to this end the great talents of Mr. Brunel were directed in his *carbonic-acid-gas engine*: and, with a similar object, Mr. Howard had attempted the construction of an *alcohol engine*; in which, the vapour being generated in the cylinder itself, the utmost compactness was obtained. In the completion of the model of the last-mentioned engine, which the lecturer had hoped to have been enabled to exhibit to the members ere this, impediments had arisen in the work which would render it impossible for him to bring the subject under their notice during his (Dr. Birkbeck's) present course of Lectures. To exonerate himself, however, for the repeated disappointments which had been experienced, the doctor read a very candid and handsome apology received by him from the ingenious inventor; in which he expressed his entire confidence in the complete success of the engine, and that he should take pleasure in exhibiting it to any member of the Institution over which the Doctor presided. [*A very full and complete Account (being the only one yet published) of this interesting Invention, with engraved illustrations, will be found in our 77th number.*]

Having been prevented from exhibiting a machine calculated for the annihilation of the great unwieldy boiler, the Lecturer proceeded to notice the attempts that had been successively made to lessen the magnitude, and increase the effectiveness of steam. The first effort to attain this object was made in the year 1774, by Mr. Blakey, [*of which a description, with an engraving, is given in the 21th page of Mr. Galloway's History of the Steam Engine, and also in the Register of Arts, No 70.*] It consists of three distinct cylinders, placed in inclined positions over the furnace, and communicating with each other by means of bent tubes. The next attempt noticed by the Lecturer was the important improvement introduced by that able mechanic, Mr. Woolf, upon the basis of which so many plans have lately been proposed and adopted with various success. In this boiler (*an engraved representation of which we shall shortly insert in our extracts from Mr. E. Galloway's History,*) a much greater surface is exposed to the action of heat, and by the peculiar arrangement of the vessels, and the construction of the furnace, they are much more effectually operated upon. Some diagrams were exhibited of this admirable apparatus of Mr. Woolf's, and the process of generating steam by it clearly explained.

The worthy Lecturer next introduced to the notice of the members the admirable steam generating apparatus of the scientific and ingenious Doctor Alban, of which some diagrams (copied from this work) were exhibited, and its construction and arrangements clearly explained; the Lecturer concluding his observations upon it by informing the members that they would find an *Account of this Apparatus in the 55th number of the Register of Arts, where it was distinctly and amply detailed.*

Some diagrams, representing Major M'Curdy's *Franklin Duplex Steam Generators*, (*copied from the original drawings in No. 73 of the Register of Arts, where a full account of the Invention is given,*) were next exhibited, and the apparatus accurately described: on concluding his remarks the doctor observed that it appeared to him to be the best attempt that had been made to generate steam, and that it promised very successful results; but, he continued, it wanted the verification of experience to prove its superiority, and it might possibly turn out, like Mr. Perkins's Steam Generators, to be more

plausible in the theory than in its results. [*A description of Mr. Perkins's Steam Engine and Boiler, with engravings, is given in our 24th number.*]

Before introducing to the notice of the members several contrivances for obviating the inconvenience attending the burning of coal, especially as attending its employment in the working of steam engines, and for domestic purposes, the Doctor took occasion to recommend the prevention or consumption of smoke in furnaces, as one particularly deserving of their attention and study: in the evolution of smoke, or volatilized carbon, a very considerable portion of what might be converted into heat was entirely lost, besides occasioning a considerable annoyance to the vicinity. In the construction of stoves for domestic use, as well as for culinary purposes, the Lecturer observed that he had to direct their attention to a very beautiful and highly successful invention, by Messrs, Atkins and Marriott, which he said embraced the rudiments of all the best attempts that had hitherto been made for the prevention of smoke, and for the economizing of heat and fuel. An elegant register stove, of this newly-patented construction, was now exhibited, and its useful properties ably pointed out and explained, which we regret we cannot properly insert in this place, as *a very copious account of these important improvements in stoves is given, with six illustrative engravings, in our 62nd number.* We ought not, however, to omit observing that the Lecturer justly panegyrized the invention, as one that approached nearly to perfection, whether applied to the drawing room, the kitchen, or other apartment or place, in which open stoves are employed.

Supposing, however, that neither this nor any other contrivance were adopted to prevent the annoyance of smoke, he had to bring under their notice a very simple and efficacious machine, to be placed on the top of a chimney, invented by a Mr. Ayliffe, a smith, in Exmouth Street, Spa Fields: a model of which was then exhibited. It represented a quadrangular pyramid with an oblong opening at each side, at equal distances one above the other, to each of which was attached a moveable curved flap of iron, so disposed that every gust of wind has a tendency to drive the smoke upwards, and increase the draft; while a blast downward from the top of the cowl, does not make the smoke descend the chimney, nor impede its ascent, but causes it to escape at its lateral openings. The efficacy of this really very clever and valuable invention was proved by some most decisive experiments, made by repeated blasts with a large pair of bellows against the delicate flame of a small wax taper, which it did not even disturb when placed at the bottom of the cowl, while it was extinguished easily by the breath when placed above. (A description of this very useful contrivance, with an engraving, is given in our 44th number.) The Doctor concluded his observations upon it, by stating that it was a complete defence against one of what were termed the two greatest evils of life, (a laugh) and we must do Mr. Ayliffe the credit of adding that we think it will go far towards remedying the other evil alluded to.

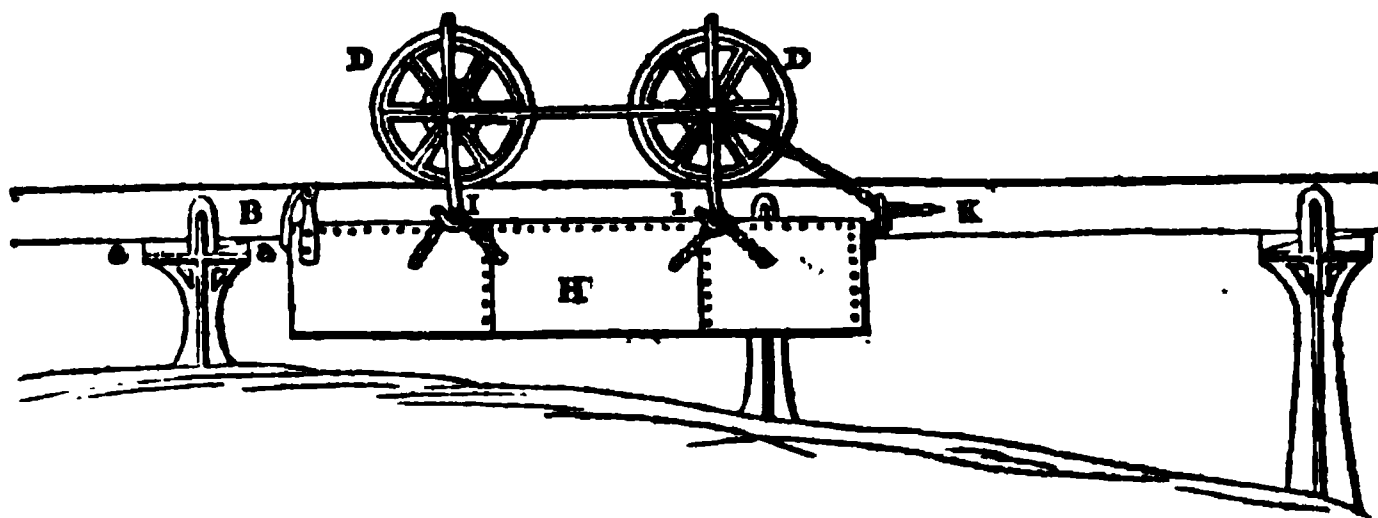
As connected in some degree with the subjects already noticed, the Lecturer next submitted an invention to the consideration of his auditory, founded on the solvent power of high-pressure steam, or water at a great temperature, by which many substances were liquefied, which could not be dissolved at lower temperatures. The earliest invention for this purpose was the *digester* of Dr. Papin, used chiefly for the purpose of dissolving the gluten of bones, for the making of soup, but he would not say how good; the solution was, however, so complete, that nothing solid remained but the earthy portion of the bones, or a phosphate of lime. On this principle a very successful attempt had been made to prepare glue from bones, by a Mr. Yardley, of Camberwell, who had taken out letters patent for his apparatus; a diagram of which, furnished by the editor of this work, was then exhibited, and the process of making glue with it from bones fully explained. [For a description of the process, with an engraving of the machinery, see No. 68 of this work.] After describing the apparatus the doctor observed, that glue made from bones was found to be more tenacious than other glue, in uniting pieces of wood; at the same time he did not consider the firm adhesion of two substances by glueing, to result from the cohesive force of the glue itself, but (as we understood him) that the glue simply afforded an excellent medium for bringing the parts

to be connected into closer contact, by filling up the pores and expressing the intervening air from their surfaces.

The next subject was Mr. Gordon's patent locomotive carriage, a large model of which was exhibited and made to run across the platform of the theatre by the lecturer's assistant turning the crank which gave motion to the propellers. To shew that the wheels were totally independent and unconnected with the propelling machinery, the wheels were raised on blocks above the level of the floor, so that the carriage remained stationary when the uniform and rapid motion of the propellers precisely resembling the action of the hind feet of horses was distinctly shewn, and how their operation was produced, explained. It was intended by Mr. Gordon to have employed Mr. Brown's gas vacuum engine as the propelling force in building the full sized carriage, but having been disappointed in the completion of a suitable power for its propulsion, nothing had yet been effected on the large scale. *A descriptive account (the earliest published) of this invention with explanatory engravings of the carriage and machinery, is given in No. 45 of this work.*

The doctor next exhibited one of those little locomotive toys which are frequently to be seen in the streets. It consisted of a painted tin model of a chariot and horses, with some wheel work concealed in a box at the back in connection with the axle of the hind wheels, which being put in motion by the re-action of a strong convoluted spring, occasioned it to run about with considerable velocity.

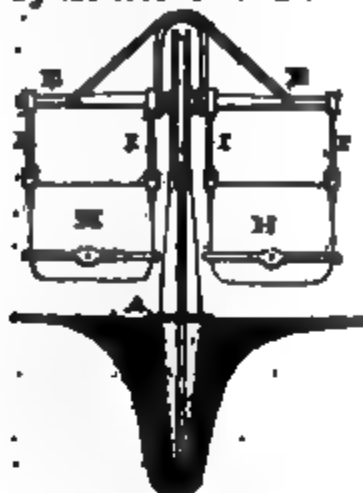
Hitherto locomotive carriages had not been successfully applied to the common roads, but on rail-roads they had of late years been employed with great advantage. The lecturer then gave a rapid historical sketch of this improved means of conveyance\* as introductory to a description of Mr. H. R. Palmer's patent suspension railway, a model of which was exhibited with the carriages upon it adapted for the conveyance of loaded casks; on the plan of that lately erected by Mr. Palmer for government at Deptford, and employed for conveying the victualling stores from the warehouses to the ships. We have already given an ample account of this admirable invention in our 7th and several subsequent numbers, with illustrative engravings, but as the subject is very justly one of intense interest at the present day, we shall be excused in repeating the observations made upon it by the learned president which we propose further to elucidate by the aid of two little diagrams, referring our readers to the above mentioned account for all the other details. It consists of an elevated single rail B composed of deal planks set on their edges and joined end to end, the upper surface being defended by cast or wrought iron plates made a little convex on their upper sides. The rail is supported upon



pillars fixed in the ground, varying in height according to the undulation of the surface of the country so as to keep the line of the rail always straight whether the plane of it be inclined or horizontal; each carriage is supported by two wheels D D which run one before the other on the surface of the rail, and to the extended axles of the wheels E E the receptacles for the goods H.

\* See Register of Arts, Vol. I. page 96.

**H** are suspended on each side of the rail by the inflexible rods **I I I I** as shewn by the cross section in the subjoined figure in the margin; by which may



also be seen the form of the pillar and the manner in which it is fixed in the ground by the ramming round it hard broken substances. A train of carriages are linked together at their extremities, and a towing rope being connected to a chain at **K** a horse is enabled to draw along a horizontal level with facility a weight equal to about 20 tons. Having described these improved arrangements, the lecturer observed that these carriages, having but two wheels instead of four or eight as required on the ordinary tramroad, the friction was reduced to a 300th part of the whole weight of their carriages and their contents, while on the best railways heretofore constructed, the amount of resistance had never been less than a 170th part of the total load drawn; from which it resulted that a force capable of moving 25,500lbs. on the latter, would move, upon Mr. Palmer's rail, a weight of 45,000lbs.

The lecturer next shewed the members, a pulley of a peculiar description which was invented by a Cornish mechanic, and was adapted for the forming of a kind of rope road to a stranded ship. When a vessel thus circumstanced has had a rope thrown to her by Capt. Manby's apparatus, or by any other means, considerable difficulty has been found to reeve an ordinary pulley for the conveyance of the crew and the goods to the shore. By the annexed figure it will be seen that the pulley divides at the hook or shackle into two equal parts, so that it may be instantaneously passed on to a stretched rope, and, by means of a cord from the ship or the shore, persons and goods might travel backwards and forwards securely and expeditiously. The screw appears to be an unnecessary appendage, as the hook could not possibly divide when in use. The little bar which traverses the opening is fixed at one end by a joint and fits into a mortice as shewn; the use of it being to confine the rope securely in its place, when a vehicle or other apparatus is slung or suspended to it. To shew the practical utility of this contrivance a strong rope was stretched from the gallery of the theatre to the platform, the pulley put upon it, to this was suspended a cross bar upon which a boy stood and descended from the gallery, he was drawn up again by a small cord, and then glided down again in perfect confidence and security: demonstrating very clearly the usefulness of the apparatus.

The Lecturer next adverted to a machine for the purpose of ascertaining the progressive motion of a carriage, commonly called a way-wiser, invented and constructed by a blacksmith, a member of the Mechanics' Institution at Darlington, the model of which was exhibited; but the arrangement of its parts, although inferior to those in general use, were very creditable to the ingenuity of the inventor, who, it appears, had no knowledge of the construction of other instruments used for the purpose.

Another machine, invented by the last-mentioned individual, was next exhibited; it consisted of a neat little model, in wood, of an apparatus for grinding optical glasses, which, appearing to us to possess considerable merit and novelty, we made a sketch of it, and here annex an engraved representation, which is a front elevation of the machine.

**a** shews the edge of a circular lap or slab, used for grinding flat glasses upon, **b** a circular block or tool, upon the under surface of which the glasses to be ground are cemented; **c** is a reciprocating bar, **d** a box to contain any

weighty matter; *e* a long morticed aperture in the frame, through which the bar *c* freely works; *f* a crank, *g* a winch, *h* a double pulley wheel, the axis of which rests in the block *i*, *j* a single pulley wheel. Now on turning the crank by the winch *g*, the bar *c* gives to *b* an eccentric motion; the attrition of *b* on the surface of the lap *a* being increased or diminished at pleasure by increasing or diminishing the load in *d*: it should also be noticed that the band or cord which passes round the pulley *h* is crossed previous to its embracing the periphery of the pulley *i*, consequently a motion is given to the lap *a* the reverse of that given to *b*, and the utmost effect of grinding is thus given by these very simple and convenient arrangements. We have now given an outline of the use of one side of the machine, which is devoted to the producing of plane surfaces to optical glasses; but the apparatus on the other side of the machine is at the same time employed in grinding glasses with convex or concave surfaces. For this purpose a variety of laps and other tools, similar



to the three first delineated in the margin, are so made as to fit at *k* on to the bed *l*; which bed is moveable and may be fixed or adjusted to any required position, by four equidistant regulating screws. The pulley *o* is driven by another band on the pulley *h*, and the required pressure given by the loaded box *p*. the use of the lowest tool, *i*, was not apparent to us, but we conjecture it is intended to fix a diamond at the point, for the purpose of cutting the glasses out in a true circular figure, by being screwed on at *m*. All the parts, and the several tools employed in the machine, which require occasional shifting, are so adapted as to enable the workman to execute those operations with great celerity and facility. Upon the whole it was evident that the machine, though slightly put together, emanated, as the worthy president observed, from "a strong mind." At the first glance at the apparatus we considered it was intended for the grinding of colours, (*i. e.* pigments,) for which its principal arrangements are admirably adapted; and our ingenious readers will, we doubt not, discover that its properties are applicable to a variety of other purposes.

In a lecture delivered to the members about fourteen months since, the president had described to them the construction and the properties of Mr. Harrison Dyer's "endless lever action" which he expatiated upon as a new discovery of a highly improved system of gearing; but it had since been attested by affidavit that Messrs. M'Dougall, of Ferrybridge, in Yorkshire, had constructed a clock on precisely the same principles, some time previous to the importation and taking out of letters patent in this country by Mr. Burnett in behalf of the inventor: (*the entire specification of Burnett's patent together with the accompanying illustrations are given in our 54th number.*) A model of Mr. D. Dougall's gearing was exhibited, and shown to be identical with that invented by Mr. Dyer in America; affording (as the doctor observed) a most singular instance of coincidence of thought and the application of it to practical purposes, between individuals several thousands of miles apart from each other. Some experiments showing the great power conferred by this improved mode of gearing were then made. The claim set up by Mr. Sheldrake to a priority in the invention was considered by the lecturer as extremely absurd; his book was incomprehensible, and his scheme equally so.

Dr. Birkbeck next adverted to the improvements that had of late years been introduced in the formation of wells, by boring the earth with augers and other tools, to a considerable depth, instead of digging it out with great labour, expense, and personal risk to the workmen employed. The ordinary tools used for this purpose were described by Mr. Hebert, "who appears to have well considered the subject," in the 13th number of the *Register of Arts*, wherein is also explained his own improvement upon them, a model of which was exhibited, and its operation explained. By the ordinary process of boring, by far the greater portion of the time occupied in the work, is employed in connecting the various pieces of rod as they are successively let down into the perforation, and in disconnecting them as they are drawn out again, to extract the earth with which the auger may be charged. By the instrument before the members, the necessity of drawing up the rod or series of rods was avoided, so as to save about nine tenths of the labour and time usually employed in the work. For the details of this invention we must refer our readers to our 13th number, observing, that some improvements have been added to it, since the publication of the paper alluded to on the subject.

The last subject expatiated upon by the learned president was a plan proposed by Mr. Russel, the engineer of St. John Street, for converting the common street pumps into fire extinguishing machines. Already had this been done most successfully at Aldgate by the projector, a large drawing of which was exhibited to the members.

To our mechanical readers we are aware that the annexed engraving of a force pump, with an air vessel, is unnecessary, as they are of course, thoroughly acquainted with its principles; our view therefore, in inserting a diagram in this place, is to make a more permanent impression upon the reader, of the momentous importance of Mr. Russel's proposition, it being in our opinion eminently calculated for the saving of life and property to a considerable extent.

The worthy president expressed also an opinion, that the adoption of the plan would be attended with the most beneficial effects in diminishing the calamitous effects of fire, by the immediate supply of a copious and powerful stream of water, acting with effect at the distance of several hundred feet from the pump; by which fires in the vicinity could generally be extinguished at their commencement, and before the engines could possibly arrive: it being evident, that a comparatively small quantity of water at the commencement of a conflagration would prove more effectual, than the utmost profusion of it at a later period. The doctor concluded his observations by expressing a hope that the members would extensively diffuse the information that had been communicated on this subject, and that the publicity given to the measure, through their medium, might lead to the general adoption of a plan admirably adapted to confer a greater degree of security against fire than they had hitherto enjoyed. In the course of the lecturer's remarks, he read a letter from Mr Russel, detailing some most successful experiments made with the fire-pump at Aldgate, from which water was delivered with great effective force at a distance of 1600 feet from two extreme points. We should take pleasure in giving a detail of these experiments, and in describing the simple arrangements made by Mr. Russel for carrying his valuable plan into execution: but we have already described them for the most part in our 31st number under the head of "THE NEW FIRE-PUMP AT ALDGATE," and want of space obliges us merely to add, that plans and estimates may be seen at No. 44, St. John Street, Smithfield, where Mr. Russel, so justly celebrated for the superior execution of hydraulic and hydrostatic machinery, resides. The pump in our diagram represents one fixed at Maidstone, by Mr. Russel.

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*To the Editors of the Register of the Arts and Sciences, Morning Chronicle, British Traveller, British Press, &c.*

GENTLEMEN,

YOUR insertion of Mr. Peter Jeffery's letter on the subject of a New Street, from the New London Bridge to Princes Street, in which he claims an originality, induces me to state that the plan was laid before the public in 1796, and from an insertion in the *Eclipse* of November 22nd, 1824, signed A Citizen, by Dr. Price, of Cannon Street, (who was known to be the author) projecting this street, which was before February 9, 1826, the date of Mr. Jeffery's claim.

Notices of a bill to come before Parliament were given in September, 1825, for streets, arcades, or colonnades, from Lothbury to London Wall, by me, the person who projected the one in Piccadilly and Holborn: and notices are also given for the next Parliament.

The idea of a colonnade in Mr. Jeffery's line is out of the question, as double the line of houses to be taken down lets for a greater rent than a colonnade will let for.

Dr. Price's plan only extended to Lombard Street; the houses in Cornhill, including the Globe, &c. and those in Princes Street to be taken down by Mr. Jeffery's plan, will cost more than Dr. Price's street, and can be of no possible advantage, or even return one penny, as no space will be left to rebuild on.

I am, your's, &c.

FRANCIS FORTUNE.

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ON THE TRANSFERENCE OF FISH FROM SALT WATER TO FRESH.  
—A letter from Mr. Meynell, of Yarm, Yorkshire, has been read to the Wernerian Natural History Society, on changing the habits of fishes, and mentioning that he had, for four years past, kept the smelt or spirling (*Salmo Eperlanus*) in a fresh-waterpond, having no communication with the sea by means of the Tees, or otherwise; and that the smelts had continued to thrive, and breed, as freely as when they enjoy intercourse with the sea.—*Edin. Phil. Jour.* xiv. 354.

THE art of preserving snow for cooling liquors was known in the days of Solomon. It was preserved in pits or trenches. The Romans purified the snow by passing it through a strainer. Before the end of the sixteenth century, it was, however, only usual in Italy, and the neighbouring states. Mixing ice with saltpetre, an art unknown to the ancients, first occurs in 1607. Lord Bacon mentions it as a new method; and about the same period we first hear of drinking cups made of ice, and iced fruit; and towards the end of the seventeenth century, the French began to congeal in this manner all kinds of well tasted juices. *Eatable ice*, called *iced butter*, was first known at the Parisian coffee-houses in 1774." The ice in which fresh salmon is packed, and sent to London from Berwick-upon-Tweed, now finds a ready sale in the metropolis, and supersedes in some degree the necessity of procuring that article from frozen ponds, and preserving it in cellars and ice-houses.

A NEW process has just been employed with much success by its inventor, M. de Succi, of Imola, to transfer fresco paintings to canvas, without stripping the walls of them. In the presence of M. Cammuccini, inspector of the fine arts, and a great number of connoisseurs, M. Succi has made a new trial of his process, on the painting called the Chronology of the Sovereign Pontiffs, in the ancient library of Sextus IV. The same artist has been equally fortunate in transferring to canvas a beautiful fresco painting by Peter della Hanceisca, representing the same Pope, Sextus IV., in the middle of other figures, and which is now to be seen among the other chefs-d'œuvres which adorn the gallery of the Vatican.

### LETTERS OF INQUIRY.

COMBUSTION OF STEAM.—*Tipton Mechanic* is desirous to be informed whether Mr. Evans's new application of steam to the purposes of combustion (described in our 49th number) is becoming extensively practised?

MINERAL GREEN.—*A Chemist* wishes to be informed of the most improved mode adopted for manufacturing mineral green on the large scale?

LOCOMOTIVE CARRIAGES.—*B. W.* having invented a new mode of propelling carriages on land; desires to be made acquainted with the best construction of a high pressure steam-engine to be adapted to it?

### TO CORRESPONDENTS.

*The monthly list of new and expired Patents will be given in our next.*

Mr. H——s's favour has been received; we purpose replying to it by the post.

We thank Mr. C, T——d for his truly valuable communication, but we fear we shall be under the necessity of postponing its insertion until our 88th number.

R. R. has quite mistaken the nature of our publication. The want of originality in the paper "On the Culture of the Silk-Worm," we regret to say, obliges us to decline its insertion.

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FOR CUTTING THE TEETH OF HORN AND TORTOISESHELL COMBS.

VOL. IV.

## London Mechanics' Institution.

### DR. BIRKBECK'S EIGHTH LECTURE ON MODERN MECHANICAL INVENTIONS.

UNIVERSAL DIFFUSION OF IRON.—IRON ORE.—PROCESS OF SEPARATING THE METAL.—CAST-IRON.—WROUGHT-IRON.—PREPARATION OF STEEL.—BLISTER STEEL.—SHEAR-STEEL.—CAST-STEEL.—WOOTZ.—CASE-HARDENING.—HARRIOTT'S WEIGHING MACHINE.—DYNAMOMETERS.—WATCH SPRINGS.—COMB-MAKING MACHINES.—PERKINS'S STEEL-PLATE ENGRAVINGS.

AN attentive survey of the arrangements of this world, as the temporary habitation of man, must convince us that whatever is most essentially necessary has been furnished to us by Nature with the greatest liberality. With respect to the metals, this remark peculiarly applies; for iron, which is the most abundant, is the most important, and the most valuable. This metal is so universally diffused, that it may be traced in almost every substance with which we are acquainted: it is found in the gem which sparkles in the diadem of the monarch, and in the clay which forms the dwelling of the humblest of his subjects; it forms a constituent part of all vegetable, and all animal matter, and of the superficial crust of the earth. Unlike metals of inferior utility, it is not distributed merely in thin veins, but occupies extensive strata, conveniently arranged near the surface, and peculiarly abounds in the northern regions of the earth, where nature has been less profuse of her other favours.

Iron is found in a great variety of forms, but only two classes of ore are in this country extensively worked; one is called *argillaceous*, from abounding in clay or alumine; the other *calcareous*, from containing an excess of lime; these, after being fused, form the *grey* and the *black cast iron*. In Lancashire and Cumberland a very rich description of ore is found in abundance, termed *hematites*, or *blood-red iron ore*, containing from 90 to 94 per cent. of metal. Several specimens of various kinds of ores were here exhibited by the lecturer. By a careful analysis of two species of very rich ore, performed by eminent French chemists by order of the Board of Mines, the following were found to be their constituents:—

| No. I.                   | No. II.                       |
|--------------------------|-------------------------------|
| Iron . . . . . 93.15     | Iron . . . . . 96.79          |
| Silex . . . . . 2.5      | Silex . . . . . .54           |
| Carbon . . . . . 2.1     | Carbon . . . . . 2.4          |
| Argyl . . . . . .8       | Phosphorus . . . . . .27      |
| Phosphorus . . . . . .75 | Argyl . . . . . } very small  |
| Lime . . . . . .5        | Chrome . . . . . } quantities |
| Sulphur . . . . . .3     |                               |
| Manganese, a trace       |                               |

To separate the iron from the volatile and earthy substances with which it is found united, the first process is that of calcination, usually termed *roasting*: the ore is laid in a furnace, together with certain proportions of coke and lime, in alternate strata, until the furnace is filled; the quantity of the coke and lime being regulated according to

the nature of the ore. After ignition the heat of the furnace is augmented by continual blasts from a large pair of bellows, or blowing machine, capable of injecting 1000 or more cubical feet of air per minute. The metal, thus fused, falls by its superior weight to the bottom of the furnace, while the earthy portion melted into a kind of glass, called *slag*, floats above. The liquid metal is then allowed to run out through an aperture at the bottom of the furnace, into moulds prepared to receive it, called *pigs*, constituting *pig-iron*, or *crude cast-iron*.

To convert *cast-iron* into *wrought*, it is again fused in what is called a *puddling-furnace*, where a "puddler" is employed in repeatedly stirring up the metal with a long rake, and in throwing water or directing a stream of air upon it; by which it is prevented from acquiring too high a temperature, and it is divested of the carbon and other matter which caused its fluidity. When there is seen upon the surface of the metal a blue lambent flame, and the metal has stiffened into a cheesy consistency, it is taken out of the furnace in lumps, and placed under the operation of a large tilt hammer, or between grooved rollers, which forms into *bar*, or *wrought-iron*.\*

The Doctor from thence proceeded to the principal object of his Lecture, namely, a consideration of the nature, composition, &c. of steel. Steel, he observed, appeared to be an intermediate state of the metal between wrought and cast-iron; the conversion of wrought iron into steel being somewhat like restoring it to the state of cast-iron. To produce steel it was necessary to unite wrought-iron again with the carbon, of which it had been previously divested in its preparation.† Attempts had been made to procure steel direct from cast-iron, but the process now generally adopted for the purpose was that termed *cementation*.

The Lecturer now referred to two diagrams representing a plan and section of a Cementation Furnace, which we here annex.

Fig. 1 is a vertical section, and Fig. 2 a plan: the dotted line in the section shows the horizontal line at which the plan is delineated, as well as its limits: in like manner the dotted line across the plan shows where the vertical section is made. In both figures the same letters of reference apply to the same parts.

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\* We had nearly prepared several diagrams, in illustration of the various processes in the iron manufacture, which we intended to accompany the above Lecture on the subject, but have been prevented by indisposition from completing them in time. We therefore propose to introduce them to our readers, together with an enlarged description of the manufacture, including a notice of all the recently patented improvements in the art, as soon as we shall have completed our insertion of Mr. Galloway's History of the Steam Engine, which we hope will be included in the present volume. In the interim we shall feel ourselves greatly indebted to any of our intelligent correspondents, practically acquainted with the iron and steel manufactures, for such information as they can conveniently communicate.—Ed.

† Mr. Mushet found the proportions of carbon, existing in different carburets of iron, to be as follows:—soft cast-steel, 120th part; common cast-steel, 100th part; the same, but harder, 90th part; the same, much harder, 80th part; white cast-iron, 25th part; mottled cast-iron, 20th part; black cast-iron, 15th part.

*a* and *b* are the troughs, called cementing pots, in which the bars of iron are laid to be converted into steel; the pots are made of a peculiar kind of stone, called fire-stone, which is not subject to crack, or liable to fuse; their dimensions are usually from 10 to 15 feet long, and from 24 to 30 inches in width and depth. The bars of iron, and the carbon or powdered charcoal, are laid in the pots in alternate strata; the upper stratum of bars being covered with a thicker layer of charcoal than those underneath; above which is also laid a mixture of sand and clay, to prevent the charcoal from entering into combustion by access to the outward air.

*s* is the external cone of strong masonry or brickwork, of from 40 to 50 feet high. Inside this superstructure is a smaller conical dome, *d*, called the *vault*, which is built substantially of fire-brick or other material capable of withstanding an intense heat. The vault rests upon vertical walls, *c c*, at a distance from those which support the external cone, and the space between them is filled up with rubbish, sand, &c. The cementing pots *a* and *b* are supported upon a series of detached courses of fire brick, leaving spaces or flues between them to conduct the flame under the pots. In the same manner the sides of the pots are supported from the vertical walls of the vault, and from each other by a few detached stones, so as to intercept the heat from the contents of the pots as little as possible. The vault has a series of short chimneys to conduct the smoke into the great cone, *c*, as shown at *ff* in both figures. In the front of the furnace an aperture is made through the external building, and another corresponding in the wall of the vault; these openings form the door, at which a man enters the vault to put in or take out the iron; but when the furnace is lighted, these doors are closed by fire-bricks luted with fire-clay. Each pot has also small openings at each end, through which the ends of two or three bars are left projecting in such a manner that, by only removing one loose brick from the external building, the bars can be drawn out without disturbing the process, to examine the progress of the conversion from time to time: these are called tap-holes, and should be placed in the centre of the pots to obtain a fair specimen of its product.

The fire grate is shown in Fig. 1, at *g*, consisting of bars laid over the ash pit *h*, which must have a free communication with the open air to supply the combustion. The attendant examines the state of the fire from the ash-pit *h*, which has steps leading down to it; and when he perceives any part of the fire not very bright or fierce, he thrusts a long hooked bar through the grating, and opens a passage for the air. The fire place has no door, being built open at each end; but a quantity of coals is piled up before each aperture, so as to close the openings, and answer effectually the purposes of doors; from this heap of coals the workman shoves in, with a kind of long hoe, such quantity as may be required to replenish the furnace from time to time, and the renewal of coals to the heap prevents any air entering the furnace but such as has passed upwards through the ignited fuel and contributed to the combustion.

The flame, arising from the ignited fuel upon the grate, passes upwards between the pots, and strikes the dome of the vault, from whence it is reverberated down upon the pots, and ultimately escapes through the flues and chimney of the vault. By these means every part of the pot is exposed to the same degree of heat, which is of essential importance. In Dr. Birkbeck's description of this furnace he observed that the large external cone was useless.

Both Mr. Nicholson and Dr. Ure have very erroneously stated the time required for the conversion of iron into steel, the former making it about 12 hours, and the latter only 8, whereas the process is never completed in less than 7 or 8 days. The Lecturer here

mentioned that some considerable improvements in the preparation of steel had been made by Mr. Thompson, of the Chelsea Steel Works; (*for which see Register of Arts, N° 51.*) When the process of cementation is completed, the bars are found to be covered with blisters and rents; they are, besides, extremely brittle, and exhibit in the fracture a crystalline structure, instead of a fibrous arrangement of its particles, as is the case with wrought-iron. These changes show that the carbon has penetrated the metal throughout; and it is not, probable that such great effects ~~can~~ have been produced by the simple mechanical union of the small quantity of carbon with which it is combined; it should rather be considered as a chemical change that has taken place by the penetration of carbon in a gaseous state, which converts it from a fibrous into a crystalline form, effecting an entirely new aggregation of its particles, and thereby conferring upon it all those singular and useful properties for which steel is so valuable. The Doctor observed that he had mentioned this view of the theory of the formation of steel by cementation to Mr. Pepys, (who was one of the ablest chemists of the present age,) and was confirmed in it by that gentleman informing him that Mr. Mackintosh, of Glasgow, had produced blistered steel by directing a current of carburetted hydrogen gas upon wrought-iron, for which he had recently taken out a patent. Mr. Pepys also furnished the Lecturer with a specimen of the steel so made, which was exhibited to the members.

Blistered steel was adapted in its crude state to but few purposes, on account of its extreme brittleness. To render it more sound and tenacious it is moderately heated in a furnace, and subjected to the operations of a tilt hammer, from which it receives about 700 blows per minute: in this state it is called *tilted steel*. To increase the tenacity of tilted steel it is cut into short lengths, and several rods of it being laid together are heated so as to enable them to be welded together by hammering; this is called *shear steel*, from the circumstance of the bars having been originally marked with the figure of a pair of shears upon it, at Newcastle, where it was first made. Shear-steel is employed extensively in cutlery, and for various kinds of steel-edged implements.

The best steel for most purposes is, however, that which has undergone the process of fusion, and subsequent hammering, designated *cast-steel*. This is produced by simply fusing blistered steel with a small quantity of charcoal and silex, or pounded glass. The cast-steel, called Huntsman's, is of very fine quality, and has been in great repute for 90 years: the name is, therefore, still preserved, though the makers of it are numerous. In France, even at the present day, they are unsuccessful in the preparation of cast-steel; and in Bombay, where very fine steel is made, they are yet incompetent to the making of cast-steel.

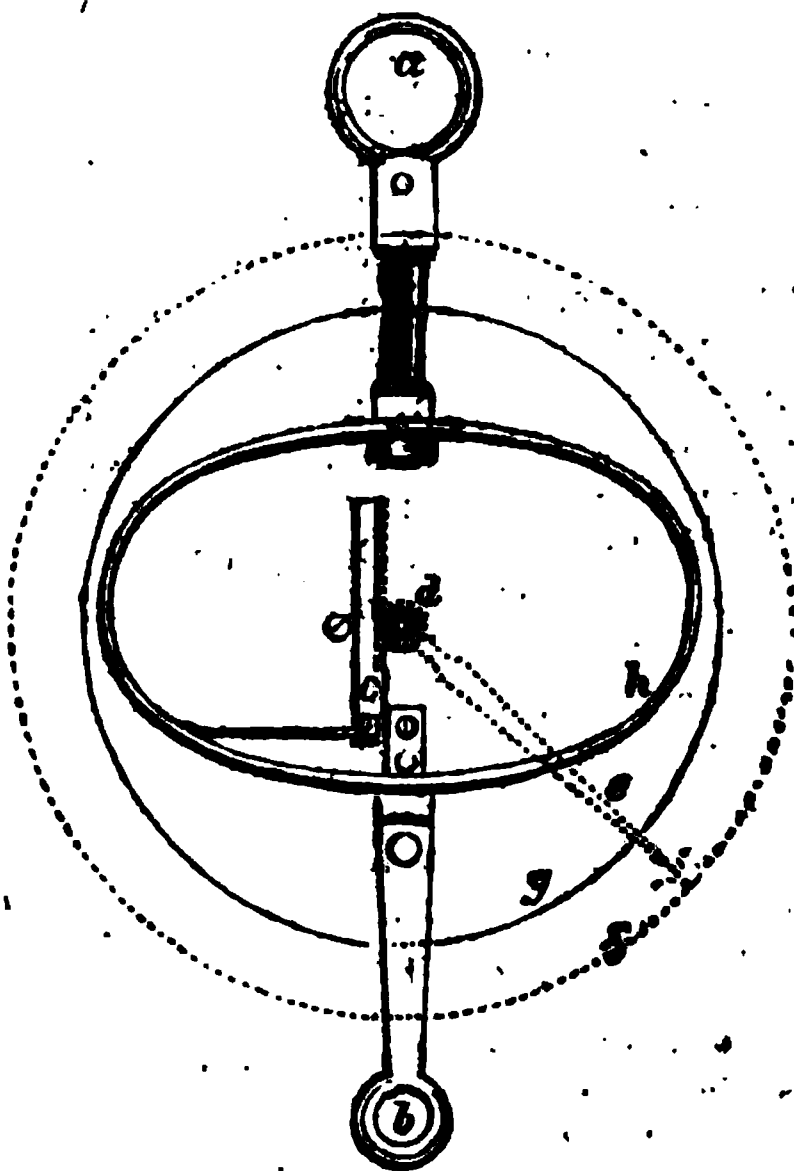
The most remarkable kind of steel is that termed Wootz, made at the expence of great labour by the natives of Hindostan. In order to obtain the necessary heat in their little furnaces, several persons are employed at a time blowing most assiduously and patiently with little pairs of bellows. On examining Wootz internally it is found to be fibrous in some parts, and crystalline in others.

Mr. Pepys had, however, succeeded in making some *cast wootz*, which were found to possess superior qualities to English cast-steel. The Doctor exhibited a razor made with this cast wootz, and observed that it was impossible to produce a more beautiful specimen of polished steel. The Hindoos, instead of employing charcoal in the preparation of their steel, make use of saw-dust, or fresh uncharred wood, which have led some authors to infer that the superiority of wootz was owing to this circumstance, a plan which the Lecturer was disposed to recommend to the adoption of the British manufacturers.

The Doctor next described the process adopted at Damascus for preparing sword blades, with what was termed the damask pattern, (*for a minute detail of which see Register of Arts, No. 67*). The process of *case-hardening* was next explained by the Lecturer, which we purpose to give a particular description of at a future opportunity; our readers will, however, find some *valuable practical hints* in our 55th number.

The Lecturer afterwards proceeded to exhibit some of the most important applications of steel, in springs of various descriptions, as employed in horological instruments; and demonstrated by calculation that the finest hair springs in watches were 630 times more valuable than the same weight of gold; this increase of value being imparted to them by labour alone. The Doctor availed himself of this opportunity to introduce to the notice of the members one of Mr. Marriott's Weighing Machines, as well as a diagram illustrating the simple construction of the internal part, which we here annex as an engraving of.

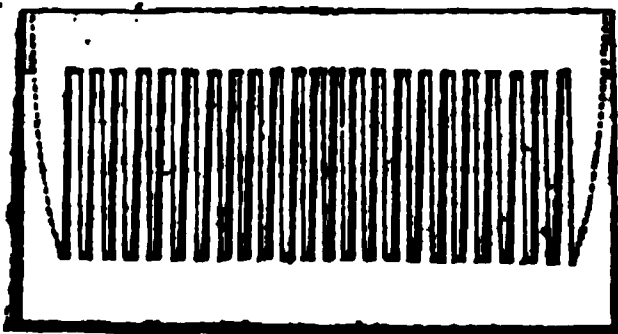
*a* is the ring by which the machine is suspended; to the stem proceeding from this ring the uppermost side of a strong elliptical steel spring is made fast by a nut and screw; at *b* is suspended the scale or other receptacle to hold the goods to be weighed; the stem of this is secured to the lowermost side of the spring, and likewise at its upper extremity to a vertical rack, *c*, which is drawn downwards as the elasticity of the spring is operated upon by the weight; the descent of the rack turns a small toothed pinion, *d*, on the axis of which is fixed a hand, *e*, that points out upon the graduated circle, *f*, the amount of the force or weight applied. The inner circle, *g*, shows the periphery of the circular box which incloses the parts delineated within it. The periphery of



the front plate and the index are shown in dotted lines, as they are not supposed to be seen in this view of the apparatus. This machine was stated to be extremely convenient and portable, no weights being required, while its action was found to be invariably very accurate.

The Doctor next noticed the construction and use of Dynamometers, but no novel or improved machine of this kind was exhibited. (*An important improvement upon these instruments has, however, been effected by Mr. H. R. Palmer, of which a description is given in our 67th number.*)

The Lecturer next brought under the notice of the members two highly-ingenuous machines for the purpose of cutting the teeth of combs, constructed by a Mr. Lyne, who had, very honourably to himself, acknowledged the great benefit he had derived in his profession, (that of an engineer) from attending the Lectures of that Institution. One of the machines exhibited was perfectly original, and reflected the highest credit upon the talents of its inventor; its object was to obviate the loss of material sustained in cutting the teeth of combs by the ordinary process; by this new machine two combs were made at once, the parts cut out from between the teeth of one comb, forming the teeth of the other, as shown by the annexed diagram.



The perfect lines show what is effected by the machine; the curved dotted line at each end has been added by ourselves, presuming that it will be necessary to make; subsequently, two such incisions, to form two complete combs, and separate them from each other; as it is evidently necessary that the end teeth of combs should be much thicker or stronger than the rest. The end teeth in one comb it will be noticed are left considerably open, which we suppose may afterwards be easily bent, and permanently fixed in their proper situation, with the application of heat.\* The machine was put in motion by Mr. Lyne, and several combs cut out of cards and pieces of horn, and handed round to the members. Its action we shall now describe, with reference to the engraving prefixed to our present number, for the drawing of which we are indebted to the kindness of Mr. Davy, the able drawing master of the Institution.†

*a a a a a* the frame of the machine made of cast-iron, *b* a lever, which turns a pinion at its lower end, and gives an alternating motion to the racks, *c c*. Each depression of the racks causes the cutter *e* to make an incision through the horn or tortoiseshell, which is placed on a bed and framing underneath; at each extremity of the cutter, *e*, a short transverse incision is made in the horn or tortoiseshell, by small chisels, *d d*, which separate the points of the teeth of one comb from the back of the other. These chisels are fixed upon sliding rods,

\* Not having had an opportunity of communicating with Mr. Lyne on this subject, we have been left to discover his mode of operating subsequently to the cutting of the teeth.

† Also teacher of Mechanical and Architectural Drawing, at No. 11, Farnival's Inn.

and are capable of being drawn backwards or forwards to suit the width of the comb. In order to give the tapered form to each tooth, and to reverse them successively, each of the two vertical bars, *ff*, have a projecting surface or wiper, that causes the cutter alternately to change its position, so as to make *angular* instead of *parallel* incisions; the bars, *ff*, being reciprocally acted upon by the descent of the racks *cc*. The comb is regularly moved under the cutters by the progressive motion of a revolving screw; one end of this screw forms also the axis to the ratchet wheel *g*, which is moved by the action of the compound levers *iii*. The fineness of the teeth of combs so cut is regulated by the teeth in the ratchet wheel, which is accordingly changed with the nature of the work. A handle is placed on the axis of the ratchet wheel, for the purpose of bringing back the frame which holds the comb to renew the operation. The whole art, therefore, in working this machine consists in raising and depressing a lever; two combs are thus formed by a single operation, with a saving of material amounting to, perhaps, three-fourths; this saving, both in labour and material, is most important in making *horn* combs, but in those of *tortoiseshell* the value is tenfold or more.

We much regret that untoward circumstances, and want of sufficient space, have prevented us from doing full justice to this excellent invention; our readers may, however, have ocular demonstration of its capabilities and its construction, by calling upon the inventor, at N<sup>o</sup>. 42, John Street, Blackfriars Road.

The other machine constructed by Mr. Lyne and exhibited, consisted of some improved adaptations of the circular saw for cutting the teeth of ivory combs; this was also put into operation, and the extraordinary facility and dispatch with which two combs were cut, containing sixty teeth in every inch, excited the admiration and astonishment of the audience. We shall take the earliest opportunity of making our readers particularly acquainted with this very clever apparatus.

The last subject treated upon by the learned president was the improvements introduced by the ingenious Mr. Jacob Perkins, on the art of *engraving upon steel*: the process adopted by that gentleman for multiplying the copies from one original engraving to an almost indefinite extent, was clearly explained. (This subject we also propose to notice at large in a future number.) The Doctor took this opportunity of correcting an erroneous impression that had been made by his observations in a previous lecture upon Mr. Perkins's mode of generating steam; his opinion, as respected that point, was, that Mr. Perkins's apparatus was capable of producing a greater quantity of steam, at a less cost, than any other machine hitherto invented.

Dr. Birkbeck concluded his course of Lectures by saying (after a few prefatory observations) that he should be happy to deliver a similar course at a future opportunity.

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ON THE AREAS AND CIRCUMFERENCES OF CIRCLES,  
THE SOLIDITIES AND SUPERFICIES OF SPHERES, &c.

*To the Editor.*

SIR, In the number of the "Register of Arts and Sciences" for the 5th August, I perceive a letter of inquiry from a *Birmingham Founder*, desiring to be informed whether or not there is a work existing in which the results of the calculation of the *areas of circles* are given, and where such a work can be procured? I beg leave to observe in reply, that I, as well as the "*Birmingham Founder*," have very materially felt the want of a work of that kind, and was induced, therefore, to set myself the arduous task of supplying such a *desideratum*. I have also the pleasure to add that the work is now completed, and making its appearance before the public under the title of "*A Series of Tables of the Areas and Circumferences of Circles of different Diameters, in three parts; with an Appendix, containing the Solidities and Superficies of Spheres, the Areas and length of Diagonals of Squares, and the Specific Gravities of Bodies, &c. intended as a Facility to Mechanics, Architects, Civil Engineers, Surveyors, Excise Officers, and Artisans in general.*" Price three shillings, neatly half-bound.

Cheapness, combined with practical utility, neatness, and accuracy, have been my constant aim throughout the whole of this little volume; and, I flatter myself, it will be found by an enlightened public that I have not materially failed of success in any of these essential points.

I am, Sir, &c.

AN ENQUIRER.

[With the above communication we received a copy of the work therein mentioned, and we cannot but acknowledge ourselves as highly indebted to its intelligent and industrious author, for the fund of useful information it conveys. From a partial, yet extensive, examination of the calculations, we are disposed to believe they are nearly, if not quite, free from error; they occupy about 76 pages of closely printed figures, but from the very neat and clear arrangement of the tables, with explanatory headings to each page, the results of any required calculations may be easily found in a few seconds. When the labour and assiduity which is required for such a work is considered, its extraordinary cheapness becomes a very remarkable circumstance. To give a brief statement of the contents of the work will, however, afford a stronger recommendation of it to all practical mechanics, than any observations we could make to shew its extensive usefulness—we accordingly extract the following.]—ED.

PART FIRST contains Tables of the Areas and Circumferences of Circles, whose Diameters are from One Inch, to One Hundred Inches, advancing by an Eighth.

PART SECOND contains Tables of the Areas and Circumferences of Circles, whose Diameters are from One Foot to Fifty Feet, advancing by an inch: from which Table may also be known, the Areas and Circumferences of Circles whose Diameters are from the Integers Twelve to Six Hundred.

PART THIRD contains Tables of the Areas and Circumferences of Circles, whose Diameters are from the Integer One to One Hundred, advancing by a Tenth.

*The former part of the APPENDIX, containing Tables of the Solidities and Superficies of Spheres, is also divided into three parts.*

**PART FIRST** contains Tables of the Solidities and Superficies of Spheres, whose Diameters are from One Inch to Twelve Inches, advancing by an Eighth.

**PART SECOND** contains Tables of the Solidities and Superficies of Spheres, whose Diameters are from One Foot to Twelve Feet advancing by an Inch; from which Tables may also be known the Solidities and Superficies of Spheres, whose Diameters are from the Integer Twelve to One Hundred and Forty-Four.

**PART THIRD** contains Tables of the Solidities and Superficies of Spheres, whose Diameters are from the Integer One to Twelve, advancing by a Tenth.

*These are succeeded by*

**TABLES**, containing the Areas and Diagonals of Squares, the Lengths of whose Sides are from One Inch to Twenty-Eight Inches, advancing by an Eighth; which Diagonals are, of course, equal to the Diameters of Circles whose Circumferences will just circumscribe the Angles of their corresponding Squares.

**TABLES** of the Specific Gravities of Bodies, in which the Weight of a Cubic Foot is given in Ounces and Pounds; the Weight of a Cubic Inch in Ounces; and the Number of Cubic Inches in a Pound, of each Body; all calculated to Avoirdupoise Weight.

*There are also added to the pages*

**HEAD LINES**, containing the common Fractions of an Inch, (*viz.* Eighths) reduced to Decimals; the Common Fractions of a Foot (*viz.* Inches), reduced to Decimals; the Number of Cubic Inches in One Cubic Foot; the Number of Square Inches in One Square Foot; the Number of Cubic Inches in One Gallon of Ale; and the Number of Cubic Inches in a Gallon, Imperial Standard.

**N. B.**—The foregoing Paper had been lying at our Printers, "set up in type," for more than a month, the pressure of other matter having prevented its insertion. In the interim Mr. George Hobert, of 88, Cheapside, has, we understand, become the Publisher of the Work, where it may be procured.]

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## History of the Steam Engine, CHAPTER IV. *continued.*

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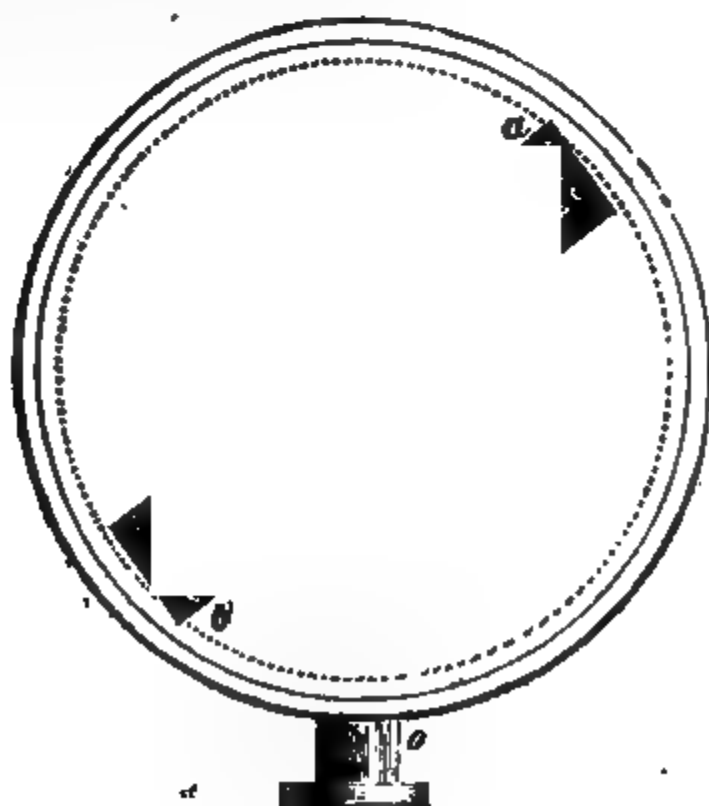
**BRAMAH AND DICKINSON'S ROTATIVE MOTION.—MR. JAMES SADLER'S ROTATIVE ENGINE.—CARTWRIGHT'S PISTON.**

The following diagram represents another method by which Messrs. Bramah and Dickinson proposed to obtain a rotative motion. A is a smaller wheel or cylinder, armed with cross sliders, fixed in a larger one B, but, instead of its axis being stationed in the centre of B, as in the previous instances, it is moved as much eccentric as to cause the periphery of A to rub against the side of B, as at C; this causes the channel or groove D D D, to be formed of the shape which appears in the figure. The inner surface of the wheel or ring B is not perfectly cylindrical, but is a curve of such a shape as would be described by the points of the sliders E F being of equal length in the revolution of the wheel A; or in other words, of such a shape as would occasion all the four points of the said sliders to be in constant contact therewith. The dotted lines G G show two grooves or cavities, through which the water, steam, or other fluid, contained between the point C and either of the apertures of the pipes H and I, passes into either of the said pipes; which water, steam, or other fluid, would otherwise be pinned up by the slider, and stop the motion of the machine when turned in either direction.\*

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\* Repertory of Arts.

This machine would be liable to the same objections as the first. On the whole these contrivances display great ingenuity, and may be justly considered to rank as high as any that have since been proposed: indeed, there are few rotative engines which do not, in principle, somewhat resemble these: therefore we conclude that, had the genius of the inventor or inventors been exercised when mechanical experience had been more advanced, they might in all probability have effected that which is so great a desideratum among modern engineers.



Mr. James Sadler, of Oxford, in 1791, obtained a patent for a Rotative Engine, which the following drawing and description may serve to illustrate. The steam generated in the boiler is conveyed through the pipe *c*, into the spindle or axis of the rotative cylinder *a b*, which is made steam-tight by working in a stuffing-box. The steam passes along the arms of the revolving cylinder, nearly to its ends, where it meets a jet of cold water, introduced from the hollow axis by the small pipe; this condensing water falls from the revolving cylinder into the bottom of the case, whence it is conveyed through a pipe, and is discharged by openings made in the ends or sides of another cylinder moveable in a horizontal direction, giving it a rotatory movement in the same manner as Barker's mill. The jet of cold water from the pipes *x x*, having condensed the steam, produces a re-action, and the cylinder *a b* acquires a rotative movement. The inner case is steam-tight; and the outer case serves the same purpose with the jacket in the reciprocating engines. Another mode of action is suggested by Mr. Sadler to be had by filling the case (in which the arms revolve) with steam, which would cause them to revolve by the pressure it would produce in being condensed in entering the arms.

This engine is Hero's in another form. That a patent should have been taken out for such an ineffective toy is a proof of great ignorance and inexperience.

The Rev. Edward Cartwright's scheme, for which he obtained a patent in 1797, was very ingenious. His object was to procure a tight piston and a condenser, in which the steam was exposed to a large surface of water.

The condensation is effected by two metal cylinders, placed one within the other, and having cold water flowing through the inner one, and enclosing the outer one. Thus the steam is exposed to the greatest possible surface in a thin sheet. Mr. Cartwright likewise has a valve in the piston, by which a constant communication is kept up between the cylinder and condenser, on either side of the piston, so that the condensation is always taking place, whether in the ascending or descending stroke. By this contrivance, steam that may escape past the piston will be immediately condensed, and the vacuum thereby preserved. This was considered to be a decided advantage over the general mode of arranging the valves, which does not always provide for the restoration of a vacuum destroyed by the imperfection of the packing.

"The piston *b* moving in the cylinder *a*, has its rod prolonged downwards; another piston *d* is attached to it, moving in the cylinder *c*, and which may be also considered as a prolongation of the steam cylinder. The steam cylinder is attached by the pipe *g* to the condenser, placed in cold water, formed of two concentric circular vessels, between which the steam is admitted in a thin sheet, and is condensed by coming in contact with the cold sides of the condensing vessel. The water of condensation falls into the pipe *e*. To the bottom of the cylinder *i*, a pipe *m* is carried into a box *n*, having a float-ball *o*, which opens and shuts the valve *p*, communicating with

the atmosphere : a pipe *g* is also fitted to the box. There is a valve placed at *i*, opening into the cylinder *c* ; another at *n*, also opening upwards. The pipe *s* conveys steam from the boiler into the cylinder ; which may be shut by the fall of the clack *r*. *k* is a valve made in the piston *b*.

" In the figure the piston *b* is shown as descending by the elasticity of the steam flowing from the boiler through *s* ; the piston *a* being attached to the same rod is also descending. When the piston *b* reaches the bottom of the cylinder *c* ; the tail or spindle of the valve *k* being

pressed upwards, opens the valve, and forms a communication between the upper side of the piston and the condenser; at the same moment the valve *r* is pressed into its seat by the descent of the cross arm on the piston, which prevents the further admission of steam from the boiler; this allows the piston to be drawn up to the top of the cylinder, by the momentum of the fly-wheel *s*, in a non-resisting medium. The piston *d* is also drawn up to the top of *c*, and the valve *i* is raised by the condensed water and air which have accumulated in *e*, and in the condenser *g*. At the moment when the piston has reached the top of the cylinder, the valve *k* is pressed into its place by the pin or tail striking the cylinder cover; and at the same time the piston *b* striking the tail of the valve *r*, opens it; a communication is again established between the boiler and piston, and it is forced to the bottom as before. By the descent of the piston *d*, the water and air which were under it in the cylinder *c*, being prevented from returning into the condensing cylinder by the valve under *i*, are driven up the pipe *m*, in the box *n*, and are conveyed into the boiler again through the pipe *q*. The air rises above the water in *a*; and, when by its accumulation its pressure is increased, it presses the float *o* downwards; this opens the valve *p*, and allows it to escape into the atmosphere."

This most ingenious machine, it appears, was tried first at Cleveland Street, Mary-le-bonne, and afterwards at Horsleydown, at both of which places it is said to have given great satisfaction. These trials must have been much more decisive than any opinion; and although we have not been able to ascertain further respecting the success of the engines when put in practice, than the simple fact of their having been approved of by the respective proprietors, our own judgment warrants a conclusion, that this plan is admirably adapted to be applied where a small engine is necessary. The objection against the mode of condensation adopted by Mr. Cartwright, was subject to great objection previous to experiment; so much so, that one of the greatest engineers this country ever produced, was heard to state it as his opinion, that "were a pipe to be laid across the Thames, the condensation would not be quick enough to work a steam engine with its full effect." It was shewn, however, when tried, that this opinion was incorrect, as the condensation was very rapid, and the vacuum tolerably good.

(TO BE CONTINUED.)

### NEWCASTLE (Upon Tyne) MECHANICS' INSTITUTION.

We learn with much satisfaction from the Newcastle and other Provincial Papers, that Mr. E. Galloway, the Civil Engineer, and author of the History of the Steam Engine, now publishing in this Work, is at present engaged in giving a gratuitous Course of Lectures on that proudest and most interesting of subjects in practical science, *the Steam Engine*, which he illustrates by numerous working

models and drawings; and we are happy to notice that his ardent exertions to gratify and instruct his very intellectual and numerous auditory, have been highly successful, and received the warmest applause.

### LIST OF NEW PATENTS SEALED.

**MUSICAL INSTRUMENTS.**—To J. C. Schwieso, of Regent Street, for improvements on certain stringed musical instruments.—22nd August. Six months.

**LOCOMOTIVE CARRIAGES.**—To T. Burstall, of Leith, and John Hill, of Bath, for improvements in the machinery for propelling locomotive carriages.—22nd August. Six months.

**HYDRAULIC MACHINERY.**—To F. Halliday, of Ham, Surrey, for improvements in raising or forcing water.—25th August. Six months.

**FLAX DRESSING.**—To R. Busk and W. R. Westley, of Leeds, for improvements in machinery for dressing, &c. flax and other fibrous substances.—29th August. Six months.

**BEDSTEADS.**—To W. Day, of the Strand, for improvements on bedsteads.—31st August. Six months.

**WOOL-DRESSING.**—To T. R. Williams, of Norfolk Street, Strand, for his invention of a machine for separating hairs, or other substances, from wool, hair and fur.—18th September. Two months.

**HATS AND CAPS.**—To T. R. Williams, of Norfolk Street, Strand, for an improved method of manufacturing hats and caps, with the assistance of machinery.—18th Sept. Six months.

### LIST OF EXPIRED PATENTS.

**INVALID BEDSTEADS.**—To George Paxon, of Hampstead, for improved bedsteads for invalids.—Dated August 28th, 1812.

**PAPER-MAKING.**—To Leger Didot, of Edgeware Road, for improved moulds for making paper.—Dated September 15th, 1812.

**FIRE-ARMS.**—To D. Egg, of the Strand, for improvements in the construction of fire-arms. Dated September 25th, 1812.

**TRAVELLING TRUNKS.**—To T. Handford, of the Strand, for a new travelling trunk or secure depository for property.—Dated September 25th, 1812.

**IRON HOOPS.**—To J. Bunn, of Lower Halliford, Middlesex, for a method of manufacturing rods and hoops from old iron hoops.—Dated September 25th, 1812.

**RAISING SUNKEN VESSELS.**—To John B. Serny, of Chelsea, M. D. for improved machinery and methods for raising sunken vessels and other property.—Dated Sept. 25th, 1812.

### TO CORRESPONDENTS.

Mr. C. T. . . . D's second favor has been received, it is intended for insertion in our 89th Number.

We thank I. M. S. for his paper on the Adulteration of Bread, but it does not appear to us to convey any new information on the matter, nor does it suggest any remedy for the evil; for these reasons we cannot well afford room for so discursive and lengthy a paper on the subject.

We exceedingly regret being under the necessity of again postponing *PHILANTHROPOS*'s very interesting Communication: it will certainly be inserted in our next.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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No. 88.] SATURDAY, NOVEMBER 11, 1826. [Price 4d.

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JOSEPH EVE'S PATENT ROTATORY PUMP.

## JOSEPH EVE'S PATENT ROTATORY PUMP.

THERE are few subjects that have received so large a share of the attention and study of philosophers, or in which the ablest mechanics of by-gone days have exercised their skill, as the construction of hydraulic machines; and, from the paucity of improvements in this important branch of mechanical science by engineers of the present day, we had almost concluded that they looked upon the labours of their predecessors with a sort of superstitious veneration that forbid any attempts at further improvements. We are glad, however, to find ourselves mistaken; to find that a spirit is abroad in this, as well as other branches of natural philosophy, which will not rest satisfied with any thing short of perfection.

We have now to announce that Mr. Joseph Eve, the patentee of the Steam Engine described in our 74th & 75th numbers, has lately introduced a Pump of a totally novel construction, in which the effect of all former pumps appears to be considerably augmented.

The machine is of the rotatory kind, and combines the properties of the *sucking* and the *forcing* pump, while it obviates their chief defects and inconveniences. It acts first as a *sucking* pump, by raising a column of water equal to the superincumbent pressure of the atmosphere; and afterwards as a *forcing* pump, in impelling the water to any required height; the great strength and simplicity of its acting parts, and the almost total absence of friction, eminently calculating it for this, its second office.

It is likewise convertible into a fire-extinguishing engine, or a garden engine, by simply screwing an air vessel on the top of the pump case: and from the peculiarity of its construction it is obvious that it may easily be converted into an effective overshot water wheel, where a small stream of water with a high perpendicular fall exists; the power of the machine in such a case being equal to the weight of the column of water (taken perpendicularly) above it.

A pump of this new construction may be seen on the premises of Messrs. Taylor & Jones, the engineers, in Jewin Street Crescent, where they are manufactured for sale on account of the patentee. Having had the opportunity of witnessing its successful operation there ourselves, we were solicitous to have the means of laying an exact description of it before our readers; accordingly, with the kind permission of the agent of the patentee, we made some sketches of the machine, of which the figures in the frontispiece are fac-similes.

Fig. 1 gives *nearly* a front elevation, a small portion of the side being seen in perspective. Fig. 2 is a similar view of the pump-case, the front plate of it and the gear which gives motion to the cylinders being removed. Fig. 3 is an air vessel, with hose and branch pipe attached, to be screwed on to Fig. 2 when employed as a garden or a fire engine. The letters of reference designate the same parts in each of the figures.

*a a* are the two cylinders revolving in contact upon their axes, and in opposite directions, each cylinder having two wings or pistons, and two grooves: in revolving, the wing of one cylinder falls alter-

JOSEPH EVE'S PATENT ROTATORY PUMP.

nately into the groove of the other, at the place where their peripheries are in contact. These two cylinders are inclosed in a case, *b b*, through the ends of which their axes project. The equal motion of the two cylinders is regulated by two cog wheels, *c c*, equal in pitch to the cylinders, which are fixed upon the extremities of the axes outside of the case. The velocity of the motion is increased by a multiplying wheel, *d*, acted upon by two winches, *e e*, placed on the axis of *d* in opposite angles. *f* is the induction pipe leading from the well to the pump case, where the pistons of the cylinders take up the water and discharge it through the eduction pipe *g*.

In Fig. 2 the interior construction of the cylinders and wings or pistons may be seen. The pump case has a flange *h* by means of which it can be bolted upon any pipe. The screw *i* on the top of the case will admit of being connected either with the eduction pipe already described, or with the apparatus, Fig. 3, by which it is converted into a fire engine.

The cylinders of the pump exhibiting at Messrs. Taylor & Jones, are only  $3\frac{1}{4}$  inches diameter by 6 inches long, and the wings only  $\frac{1}{2}$  of an inch wide and 6 inches long; and two men turning the winches (before mentioned) raise 1100 lbs. of water in 3 minutes, from the well which is 21 feet below.\*

Some of the advantages of this pump that do not pertain in as great a degree to other pumps, are considered to be:—

1st, Being made of metal, and having but two moving parts, and requiring no *leathering* whatever; in fact, having *no parts that rub except the axes or pivots of the cylinders*, it cannot wear much, or get out of order.

2ndly, The motion being rotatory, and there being no valves to be opened and closed, the speed of the pump may be increased to almost an unlimited degree, if needful, (which on board of ships may frequently be desirable, and may be the means of saving lives and valuable property,) by applying more power; and the quantity of water raised will be in exact proportion with the velocity and the force applied.

3rdly, More men can work at it than at other pumps without being in each other's way, by means of a simple handle in small pumps, or a winch or capstan in larger and ship's pumps.

4thly, By unscrewing the water discharging pipe on the top of the pump case, and substituting an air vessel with a hose and pipe, the machine is at once converted into the most simple and effectual fire extinguishing engine.

5thly, It occupies much less room than other pumps, and the weight and expense of pump work for deep mines is reduced in the same proportion.

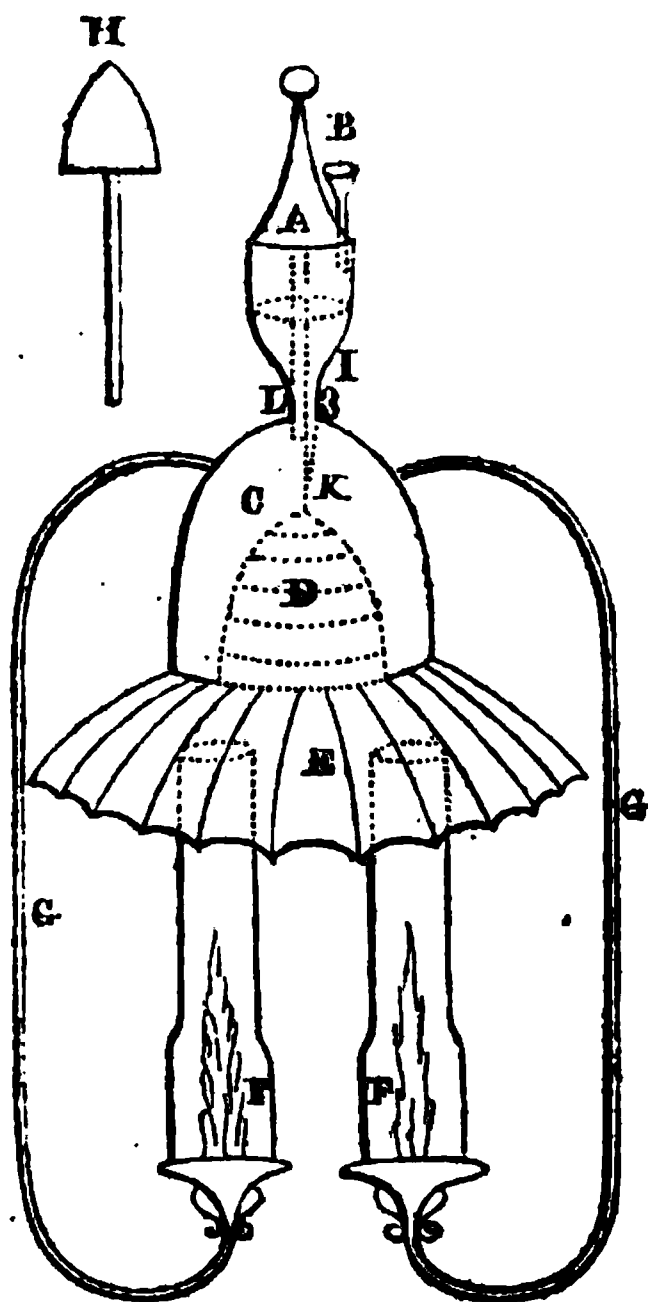
6thly, The friction being reduced to almost nothing, more water can be raised by this pump with a given power than by ordinary pumps.

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\* According to Nicholson's "Operative Mechanic," page 52, it would require the power of nearly four men (viz. 3.85) to raise the same quantity of water, in the same time, to the same height.

## SELF-GENERATING GAS LAMP.

(From the Edinburgh Philosophical Journal.)



THE oil vessel of this lamp is represented at A. B is the tube by which the oil is admitted; C is the generator; D is a hollow vessel, where the heat from the burners F, underneath, is collected; the dotted lines are projecting ridges on it, within the generator, to prevent the oil running down and collecting at the bottom of the generator. E is a circular piece of iron to collect and retain the heat. G are tubes to conduct the gas from C to F. L is a tube to supply the vacancy in A with gas, as the oil is discharged into C. H is a metal heater to fit into D.

To use the lamp, fill A partially with oil, alcohol, or any fluid from which gas is produced, and having made the metal-heater H red-hot, place it in the bulb D; after

it has continued in it a minute or two, turn the stop cock I, allowing the fluid to drop slowly on the heated bulb D, below, by which it will be converted into gas. When it is found to escape in sufficient quantities from the burners at F, set it on fire, remove the heater, and a beautiful bright flame will be supported by its own heat as long as there is oil in A.

It may be found necessary to replace the first heater by a second, when the lamp is used for the first time, to expel more effectually the atmospheric air from the generator and tubes. The heat collected in D will be found sufficient to generate gas to a third burner if required, as it is an indisputable fact, that most bodies in a state of combustion give out much more heat than is requisite to support an equal body of flame, and this is quite evident by fire spreading so rapidly in all combustible substances, if not checked.

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## IMPROVED METHOD OF CALCULATING TABLES.

WE have much pleasure in introducing to our readers the following communication, containing a new and very ingenious method of cal-

culating the areas, &c. of circles, which is likely to be of great importance to those engaged in tabular calculations. It has enabled the indefatigable inventor to complete a set of tables of great utility to practical men; and it will, doubtless, be the means of enlarging extensively, the important plan of treasuring up in tables the labours of the mathematician for the ready use of the man of business.]

*Bolton, Nov. 6, 1826.*

Mr. EDITOR,

Sir,—My little work, entitled “A SERIES OF TABLES OF THE AREAS AND CIRCUMFERENCES OF CIRCLES, &c.” has already been introduced to your notice, and you have been pleased to regard it with that attention which, however deserved by its merits, could not be, and was not anticipated by its author. But while I feel grateful to you for the handsome manner in which you have been pleased to introduce it to the attention of the public in your valuable Miscellany, I also feel confident that it is by the estimation of the public alone that it must stand or fall. But while, stranger-like, it is making its way through villages, towns, and cities, it is highly desirable that it should be accompanied with every recommendation which its author can, with propriety, bestow upon it, because it is probable that it will have to contend with a great deal of prejudice.

As accuracy in tabular works is always a matter (if not of the first) of very great importance, I will trouble you, Sir, with a kind of analysis of the method made use of in calculating those tables, which method will, I hope, not only show the very high degree of accuracy which it is capable of producing, and which the tables must have derived; but also exhibit to the mathematical world something new, perhaps, in the theory of numbers; at least it is something new to me, and to all those persons to whom I have hitherto had the pleasure of describing it. I do not, Sir, make any high pretensions to mathematical or other learning, being in these respects, entirely self-taught, and having had, moreover, to labour under great and innumerable disadvantages. It may, however, be some recommendation to me to state, that I learned my present business of *Engineer and Draughtsman*, under the immediate instruction of the late ingenious Mr. Matthew Murray, of Leeds, in whose employ I had the pleasure to remain for about nine years. It was the want of a set of tables of the above kind, for my own practice, which first induced me to undertake the work, and it was solely under a conviction that they would be of considerable use to others which caused me to extend the plan, and commit it to the public. At first I undertook the laborious task of working out each calculation at full length, proving them by casting out the nines; and in this manner I had almost finished the work, when another method of performing the operation suggested itself to me, and it is to this method which I beg leave further to solicit your attention.

In the course of my labours, I perceived that the products of all the operations advanced by a regular ratio, and conceived an idea that it might be possible to find out what that ratio was, and conse-

quently make a process of addition serve, instead of multiplication. I therefore set myself to think on the subject in this point of view, and came to the conclusion that, if I took the products of several successive operations, and subtracted them one from the other, and their remainders one from the other, till nothing remained, I should at length come at this ratio; which, on making the experiment, I found to be the case, as follows:—

The ordinary method of obtaining the area of a circle is by squaring the diameter, and multiplying the product by .7854, thus:

|                             |                        |                         |
|-----------------------------|------------------------|-------------------------|
| Dr. of $1\frac{1}{2}=1.125$ | of $1\frac{1}{2}=1.25$ | of $1\frac{1}{2}=1.375$ |
| 1.125                       | 1.25                   | 1.375                   |
| <hr/>                       | <hr/>                  | <hr/>                   |
| 5625                        | 625                    | 6875                    |
| 2250                        | 250                    | 9625                    |
| 1125                        | 125                    | 4125                    |
| 1125                        | <hr/>                  | 1375                    |
| <hr/>                       | 1.5625                 | <hr/>                   |
| 1.265625                    | .7854                  | 1.890625                |
| .7854                       | <hr/>                  | .7854                   |
| <hr/>                       | 69500                  | <hr/>                   |
| 5062500                     | 78125                  | 7562500                 |
| 6398125                     | 125000                 | 9453125                 |
| 10125000                    | 109375                 | 15125000                |
| 8859375                     | <hr/>                  | 13234375                |
| <hr/>                       | 1.22718750 Area.       | <hr/>                   |
| .9940218750 Area.           | <hr/>                  | 1.4848968750 Area.      |
| <hr/>                       |                        | <hr/>                   |

Then the area of  $1=.7854$ , of  $1\frac{1}{2}=.9940218750$ , of  $1\frac{1}{2}=1.22718750$ , and of  $1\frac{1}{2}=1.4848968750$ . Now taking these products, and subtracting them one from the other, and their remainders, one from the other, till nothing remain, we shall obtain what may be termed a *sign fluent* and a *sign constant*, thus:

|                                   |                                     |                                      |
|-----------------------------------|-------------------------------------|--------------------------------------|
| .9940218750 $=1\frac{1}{2}$ diam. | 1.22718750 $=1\frac{1}{2}$ diamtr.  | 1.4848968750 $=1\frac{1}{2}$ diamtr. |
| .7854 $=1$ diam.                  | .9940218750 $=1\frac{1}{2}$ diamtr. | 1.22718750 $=1\frac{1}{2}$ diamtr.   |
| <hr/>                             | <hr/>                               | <hr/>                                |
| .2086218750 sign fluent           | .2331656250                         | .2577093750                          |
|                                   | .2086218750 sign fluent             | .2331656250                          |
|                                   | <hr/>                               | <hr/>                                |
|                                   | .0245437500 sign constant           | .0245437500 sign constant            |
|                                   | <hr/>                               | .0245437500 sign constant            |

Then taking the area of  $1=.7854$ , as the *seriamic logarithm*, or the *logarithm of the series*, (these are names of my own appropriating merely for the sake of distinction in terms), and adding to it the *sign fluent*, the next area will be obtained; i. e. the area of a circle whose diameter is advanced by  $\frac{1}{2}$ ; and the *sign constant* and the *sign fluent* added together, and placed below this area, will give a next product, or a *fluent quantity*, to be added to the last area, for

the next, the diameter of whose circle is advanced by the same ratio, viz.  $\frac{1}{4}$ . Then the *sign constant* added to the last *fluent quantity*, will give another product to be added to the last area for the next; and so forth, *ad infinitum*. For example:

|         |                     |         |       |    |
|---------|---------------------|---------|-------|----|
| ·7854   | Serial. log. 1      | 3·97608 | 75000 | 2½ |
| ·20862  | 18750 sign fluent.  | ·45405  | 93750 |    |
| ·02454  | 37500 sign constant | ·02454  | 37500 |    |
| ·99402  | 18750 area 1½       | 4·43014 | 68750 | 2½ |
| ·23316  | 56250 sign fluent   | ·47860  | 31250 |    |
| ·02454  | 37500 sign constant | ·02454  | 37500 |    |
| 1·22718 | 75000 1½            | 4·90875 | 00000 | 2½ |
| ·25770  | 93750               | ·50314  | 68750 |    |
| ·02454  | 37500               | ·02454  | 37500 |    |
| 1·48489 | 68750 1½            | 5·41189 | 68750 | 2½ |
| ·28225  | 31250               | ·52769  | 06250 |    |
| ·02454  | 37500               | ·02454  | 37500 |    |
| 1·76715 | 00000 1½            | 5·93958 | 75000 | 2½ |
| ·30679  | 68750               | ·55223  | 43750 |    |
| ·02454  | 37500               | ·02454  | 37500 |    |
| 2·07894 | 68750 1½            | 6·49182 | 18750 | 2½ |
| ·33184  | 06250               | ·57677  | 81250 |    |
| ·02454  | 37500               | ·02454  | 37500 |    |
| 2·40528 | 75000 1½            | 7·06860 | 0     | 3  |
| ·35588  | 43750               | ·60132  | 1     |    |
| ·02454  | 37500               | ·02454  | 3     |    |
| 2·76117 | 18750 1½            | 7·66992 | 1     | 3½ |
| ·38042  | 81250               | ·62586  | 5     |    |
| ·02454  | 37500               | ·02454  | 3     |    |
| 3·14160 | 00000 2             | 8·29578 | 7     | 3½ |
| ·40497  | 18750               | ·65040  | 9     |    |
| ·02454  | 37500               | ·02454  | 3     |    |
| 3·54657 | 18750 2½            | 8·94619 | 6     | 3½ |
| ·42951  | 56250               | ·67495  | 3     |    |
| ·02454  | 37500               | ·02454  | 3     |    |
|         |                     | 9·62115 | 0     | 3½ |

It will be perceived, on comparing the area of 1, 1½, 1¾, &c. with those of 2, 2½, 2¾, &c. that there is a regular recurrence of the same figures on the right hand of the decimals, viz. of all those on the right of the vertical line up the middle of each column; and, therefore, a considerable abridgement of labour and figures may easily be made in this mode of calculation, which could not so well, if at all, be adopted in the ordinary method. The lower part of the second column is an example of the abridged method.

In calculating the circumferences of circles the same method was adopted. But as the rule for calculating the circumference of a circle is more simple than that for obtaining the area, so is the method adopted here proportionately simple. The ordinary rule is, "multiply the diameter of the circle by 3·1416, and the product will be the circumference:" thus—

|                                  |                         |
|----------------------------------|-------------------------|
| Diameter of $1\frac{1}{2}=1.125$ | of $1\frac{1}{2}=1.25$  |
| 3.1416                           | 3.1416                  |
| <hr/>                            | <hr/>                   |
| 6750                             | 750                     |
| 1125                             | 125                     |
| 4500                             | 500                     |
| 1125                             | 125                     |
| 3375                             | 375                     |
| <hr/>                            | <hr/>                   |
| 3.5343000 circumference          | 3.927000 circumference  |
| 3.1416 circumference             | 3.5343000 circumference |
| <hr/>                            | <hr/>                   |
| .3927000 sign constant           | .3927000 sign constant  |
| <hr/>                            | <hr/>                   |
|                                  | 3927000 sign constant   |
|                                  | <hr/>                   |

Now taking the circumference of  $1=3.1416$  as the *log. of the series*, and adding to it the *sign constant*, a circumference will be obtained, the diameter of whose circle is equal to  $1\frac{1}{2}$  : and the *sign constant* added again to the last circumference or product, will give another circumference, the diameter of whose circle is advanced by  $\frac{1}{2}$  more, and so forth, *ad infinitum*, as shewn by the following example :—

|                                  |           |                |
|----------------------------------|-----------|----------------|
| 3.1416 seriam. log. 1            | 6.2832000 | 2              |
| .3927000 sign constant           | .3927000  |                |
| <hr/>                            | <hr/>     |                |
| 3.5343000 circum. $1\frac{1}{2}$ | 6.6759000 | $2\frac{1}{2}$ |
| .3927000 sign constant           | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 3.9270000 $1\frac{1}{2}$         | 7.0686    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 4.3197000 $1\frac{1}{2}$         | 7.4613    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 4.7124000 $1\frac{1}{2}$         | 7.8540    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 5.1051000 $1\frac{1}{2}$         | 8.2467    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 5.4978000 $1\frac{1}{2}$         | 8.6394    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
| 5.8905000 $1\frac{1}{2}$         | 9.0321    | $2\frac{1}{2}$ |
| .3927000                         | .3927     |                |
| <hr/>                            | <hr/>     |                |
|                                  | 9.4248    | 3              |

It will be perceived at once that the ciphers on the right hand of the decimals in the above columns may be dispensed with, without any inconvenience.

Thus, Mr. Editor, was I enabled to complete the first part of my book. The second was attended with rather more trouble, on account of the occurrence of several endless decimals in the 12ths of a foot, which caused the signs to come out not without a remainder, which remainder was not to affect the operation within the limits of those decimals to be recorded in the tables. This, however, I accomplished with the same advantage over the original method of squaring the diameter, &c. as is manifest above, and which I intend, Sir, by

your permission, to make clear in a future letter for the "Register of the Arts and Sciences." In the mean time I beg leave to subscribe myself,

Sir,

Your obedient Servant,

AN ENGINEER.

## TELEGRAPHIC COMMUNICATION,

BY MEANS OF SOUND PRODUCED BY ELECTRICAL ACTION.

*To the Editor.*

MR. EDITOR,

ON perusing one of your interesting numbers for April, 1825, I observed a proposal in it, by a gentleman of the name of Vallance, for an improved method of Telegraphic Communication, by means of forming an artificial vacuum in a metallic tube. Of its merits or disadvantages I do not intend to discuss; I only wish, through the medium of your widely-circulated Register, to acquaint the public of a plan which suggested itself to me a few years ago, when engaged in a course of philosophical studies, which will accomplish the same end with the utmost precision, and with the rapidity of lightning. I was fully convinced at that time of the utility and practicability of the plan, from having repeatedly proved it on a small scale in my laboratory; and I now entertain not the slightest doubt on the subject. It is by means of *sound* produced by the *collision* of *bodies* in *opposite states* of *electricity*; these bodies, consisting of a series of small balls, suspended at the extremities of metallic conductors by slender chains, and a series of numbered bells hung within their sphere of action. I will illustrate the intended scheme by an example, which will easily be comprehended by any of your readers who are in the least acquainted with the laws of electric motion.

Let a metallic wire, coated with a non-conducting substance, be extended under ground between any two given places, which, for the sake of experiment, may be two separate apartments in the same house: one of which may be denominated A, and the other B. In the apartment A place an electrical machine, and to the extremity of the wire in B a little ball, suspended by means of a very slender chain, within whose sphere of action there is a common bell. Now, by connecting the wire in A with the conductor of the machine, the electric fluid will pass instantaneously along it, and charge the ball in B through the medium of its little chain, which flies off immediately to the uninsulated bell, to discharge its surplus of electric matter, and recover its equilibrium. The force by which it is attracted or impelled towards the bell is quite sufficient to produce the sound required; it is an experiment which I have often made, and with invariable success. Let this bell be numbered 1, and have a series of them up to 10, with separate and distinct metallic conductors, it is evident to a demonstration that, by a combination and the successive excitement of these simple numbers, the whole of those at present made use of in our most improved telegraph and signal books, together

with their corresponding meanings, may be conveyed from the apartment A to B with the greatest accuracy, and with the speed of thought.

Thus, by this simple and inexpensive means, (by two electrical machines and a double series of wires with their appendages,) say between Portsmouth or Plymouth and London,—news of the greatest political importance may be conveyed in a few minutes, by a gentleman connected with the apparatus at either of these places; he has only to excite the wires which correspond to each individual number of the telegraph made to him by the common flag signals, which will, in almost the same instant of time, affect their corresponding bells in London, and give the necessary intelligence in a series of numbers, whose symbols will be found by referring to the signal books now in use.

“Lives there the man whose universal eye  
Hath swept at once the unbounded scheme of things;  
Mark'd their dependence so, and firm accord,  
As with unfaltering accent to conclude  
That *this availeth nought?*”

The insertion of the above will much oblige,  
PHILANTHROPOS,  
A CONSTANT READER.

PROPOSED NEW BRIDGE ACROSS THE THAMES,  
FROM LAMBETH TO THE HORSE-FERRY ROAD, WESTMINSTER.

*To the Editor.*

SIR,

The enclosed is a plan of the site for a proposed new Bridge, from Lambeth to Westminster, with a branch road communicating with Pimlico; should you deem it worthy your notice for your valuable periodical work, the Register of Arts, I beg to say it is at your service, and shall feel obliged by your giving it a place at your convenience: the proposition for the undertaking was submitted to the public last year, (as you will perceive by the accompanying prospectus) and only suspended from the peculiar turn in the times; it has been, and still is, considered an undertaking highly advantageous.

I am, Sir,

Stamford Street,  
Oct. 5th, 1826.

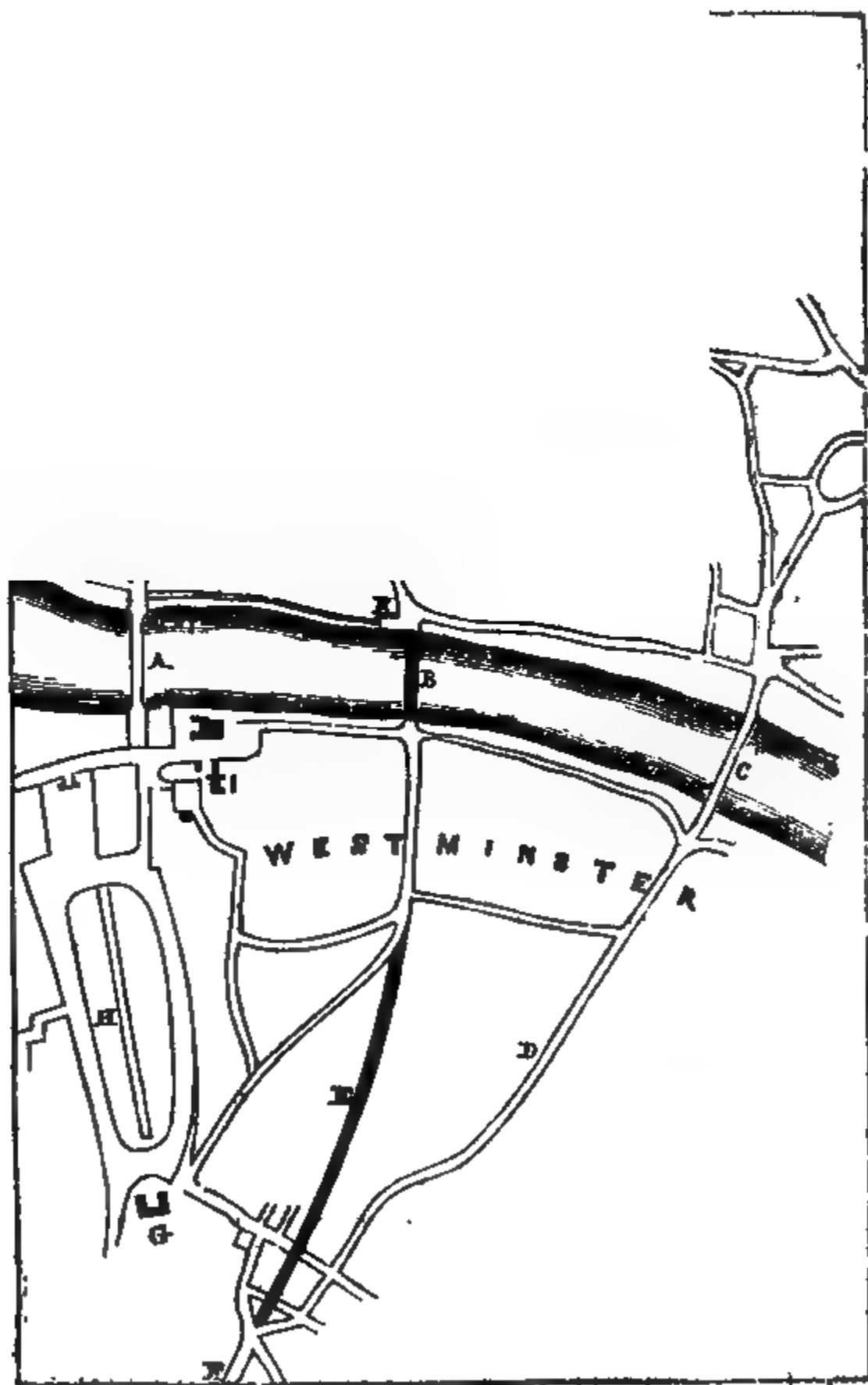
Your most Obedient Servant,  
C. HOLLIS.

*Reference to Engraving.*—A Westminster Bridge; B proposed new Bridge; (black) C Vauxhall Bridge; D Vauxhall Road; E proposed new Branch Road to Pimlico; (black) F Grovesnor Place; G New Palace; H St. James's Park; I Abbey; K Lambeth Palace; L Obelisk, St. George's Fields; M Elephant and Castle; N Road to Greenwich, Dover, &c.; O Road to London Bridge.

A slight inspection of the map of London, must, we think, convince every body of the advantage (we had almost said necessity) of this proposed new Bridge; but those who have like ourselves repeat-

edly experienced the inconvenience of the circuitous road between Millbank and Lambeth, will need no such illustration.

The extent and increasing importance of that portion of London which lies to the westward of Westminster Bridge, enhanced, as it will shortly be, by the residence of the King at the new Palace, and



of the opulent in the new Square and Streets now building on Lord Grosvenor's Estates at Pimlico and Chelsea; with the increase of trade and commerce which naturally results from a populous and wealthy neighbourhood, will require more facility to be given to the communication of that part of the Town with the opposite shore and the country adjacent, than is at present afforded.

The proposition is to erect a Cast Iron Bridge, of seven Arches, with Stone Piers and Abutments, stretching from Church Street, Lambeth, near the Archbishop's Palace, (and where a ferry has existed for many years,) to the Horse-ferry Road on the opposite shore; and from whence the Road will lead directly through Pimlico, into the great Western Road at Hyde Park Corner, and by Grosvenor Place, Buckingham House, Belgrave Square, and all the adjacent parts of that improving and wealthy neighbourhood.

From the Elephant and Castle, the point from which so many roads diverge, a considerable saving in distance will be effected by this new route, in preference to the road over the Vauxhall or Westminster Bridges; a circumstance of itself sufficient (exclusive of all the local advantages) to establish the eligibility of this proposed undertaking.

The practicability of the measure will be apparent to all who are conversant with the site;—on each side there are good open roads down to the very banks of the river, and no part of which will require to be raised more than four feet: consequently the enormous expences which other Companies have been put to, in the formation of their approaches, will be here avoided. It is computed that the whole cost of land, &c. necessary to be purchased for cutting through into the main road at Pimlico, and for other necessary purposes, may be more than realized by the sale or letting of such land, when converted into frontage in the improved neighbourhood, which will certainly follow upon the completion of this undertaking.

|                                                                                                                                                                                                                                         |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Total cost of building the Bridge, including every expence in that department .....                                                                                                                                                     | £112,500        |
| For Land (including Buildings to be pulled down) necessary to be purchased, in order to throw the approaches open to the main Roads on the Westminster side, and for completing the Roads; and including compensations and expences.... | 51,000          |
|                                                                                                                                                                                                                                         | <u>£163,500</u> |

## History of the Steam Engine, Chap. IV.

*Continued from p. 239.*

### CARTWRIGHT'S ROTATIVE ENGINE.—HORNBLOWER'S ROTATIVE ENGINE.

Not the least ingenious part of Mr. Cartwright's patent was the metallic piston, which has been of late years very generally used. Though this kind of piston is now somewhat differently modified from his, yet he is entitled to the merit of having first introduced it into use. It has been found to answer extremely well, and frequently

works for years without requiring any other attention than that of being kept well greased.

Mr. Cartwright's consists of two rings of brass of the full size of the cylinder, which are cut into segments, as shewn at *l l l*, and laid one above the other, so as to *break joint*. The joints, therefore, in the under ring are shewn by dotted lines in the figure, and being thus disposed the two rings are secured in their places by a top and bottom plate, to which the piston rod is fixed. The segments are pushed against the cylinder by steel springs, shewn at *a a*.

A Rotative Engine is also described in this specification ; but we apprehend that practical difficulties would prevent its being ever carried into execution. The axis *D* is fixed in an internal drum or cylinder, to the periphery of which are attached the three pistons *H H H*, which entirely fill the channel formed between the interior and exterior cylinders ; *dd* are two valves, or flaps, which when shut

into the cavities, form a portion of the exterior cylinder, but when open (as drawn), serve as a *butment* to receive the action of the steam, which being introduced between a valve and piston, and stopped from escaping past them, acts upon any of the pistons H, which recede from the pressure, and cause the drum and axis D to revolve. The flaps *d* relieve each other, so that one of the pistons is passing one at the time the other is open, and receiving the force of the steam. Mr. Cartwright does not describe how these pistons and valves are to be made, or being made, how they are to be kept tight. Two methods only are known, namely, hempen or metallic packing; the first would be soon destroyed by the holes in the sides of the exterior cylinders, formed for a communication with the boiler and condenser, by means of the pipes E E F, and metallic packing would here require too much nicety and expense to be generally useful. But this is not all. The friction of the interior drum would far exceed that of the common engine, which it was intended to supersede, and the flaps, *d d*, would be extremely liable to knock themselves to pieces by the frequent striking against the drum, as they are thrown forward by the external machinery.

Mr. Jonathan Hornblower's Rotative Engine (for which a patent was obtained in 1798) displays much ingenuity. The vessel in which the steam operates consists of a hollow cylinder, composed of two unequal parts, the smaller section of which is screwed off and on, for the purpose of rectifying and repairing the internal structure. These parts are cast separate, and then screwed together, firm and close, by means of flanches. They are then covered with lids turned also true, and form a figure resembling a drum. A Z are two tubes, which pass through the central openings in the lids of the drum, meeting each other at B. *a b c d*, are the interior limits of those tubes, on the inside of the drum, which are considerably larger than at A Z in their diameters; the use of which is, that there shall be a proper cavity at *e f g h*, to receive a packing of tow and grease, or any other materials answering the purpose, between that particular part and the end of the drum; and also the frames of the diaphragms C C, may have the firmer holding to the hollow axles or tubes at D D, leaving the parts of the diaphragm pendent at *i h*. The dotted lines show the interior limits of the drum, when the diaphragms are in their places; between which and the extremities of the diaphragms there is a proper rabbet to receive the packing, and between the pendent part of the diaphragms and the central hollow tube about which it revolves. This rabbet is formed by means of plates of metal, screwed on to the frame of the diaphragms, having their edges nearly in contact with the inner surface of the drum, and will be found accessible to repair or renew the packing, when the pannel which constitutes a part of the drum is removed. The parts *e f g h* may also be repaired at the same time, by means of removing two screws at each end of the hollow tube. The diaphragms (which are here standing in opposite directions) may therefore freely revolve the one after the other, or one may move whilst the other remains stationary. The tubes to which they are attached will have their



Fig. 1  
 concentricity preserved by means of the solid axis within the hollow one at E, which is fixed to the end of the tube Z, and passes closely through a hole in the end of the tube A, till it reaches the extremity; where, by means of a second collar, its central position is critically maintained. The two diaphragms are hollow within, and hold communication with the cavities of their respective tubes which compose the hollow axes; and these communications are made by oblong openings where the diaphragms and tube are connected at D D.

The diaphragms are completed when these plates are screwed on; in these plates are fixed two valves G, opposite to which are two others, one in each diaphragm, so corresponding, that at the opening

of one the other is closed, and *vice versa*. These valves are balanced and held in trunnions, so that, in every situation of the diaphragms, they may uniformly obey the impulse by which they are opened and shut; the manner in which that is effected is as follows:—The two diaphragms widen towards their extremities in the manner of radii, (see *Fig. 2*) and may therefore be brought into sufficient contact to force open the valves by means of prominences on them for the purpose.

(TO BE CONTINUED.)

## MINERAL GREEN.

*To the Editor.*

SIR,

HAVING read the N<sup>o</sup>. 86 of the 'Register of Arts and Sciences,' and finding in one of the Articles that a Chemist wished to be informed of the *most improved mode adopted for manufacturing Mineral Green on the large scale*,—I take the opportunity to acquaint you that having found a very accelerate way of preparing a Mineral Green of various tints, without much expense. I will be glad to communicate with the gentleman who inserted that inquiry in the Register.

I am, Sir,

Oct. 26, 1826. Your very obedient humble Servant,  
Pellatt & Green, St. Paul's, No. 16. SAINT AMAND.

## TO OUR READERS AND CORRESPONDENTS.

**MECHANICS' INSTITUTIONS.**—A copy of that truly excellent and valuable Work, the *Repertory of the Arts*, from its commencement, (without which no library on mechanical science can be complete) may be had cheap, in excellent binding and condition, of the publishers of this work.

J. S.'s Letter has been received; we have no room to reply now to its contents; in the mean time J. S. may have ocular proof of his error, by seeing the machinery at work in Addle Street.

The Sawing Machinery mentioned by R. A. D. will be inserted in our next; which number will also contain five or six other patented inventions, as well as four steam engines; all of which will be illustrated with engravings.

Let A STUDENT look at the Index of our Third Volume, and he will find no less than eight modern inventions for the purpose.

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# REGISTER

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DENNISON AND HARRIS'S PATENT PAPER-MAKING MACHINE.

## DENNISON & HARRIS'S PATENT PAPER-MAKING MACHINE.

THE art of making paper, in one continuous sheet of any required length, our readers will recollect originated from an ingenious Frenchman of the name of Didot, who, in conjunction with Messrs. Fourdrinier, succeeded after the expenditure of enormous sums of money, in perfecting and establishing this important improvement. By their method the pulp was delivered in a thin uniform stratum upon an endless web of woven wire stretched between and over two revolving cylinders, whose axes were on the same horizontal plane. This endless web of wire work formed the mould, and became the vehicle for carrying forward the newly-made paper to be operated upon by the subsequent processes. The mechanism of these machines, especially as now manufactured by that able engineer, Mr. Donkin, of Bermondsey, is highly curious and beautiful.

Subsequent to the period alluded to, several variations from the method adopted by Messrs. Didot and Fourdrinier, but nearly on the same principle, have been applied to the making of paper; among which that invented by Mr. Dickenson, in 1809, should be mentioned, as it bears a considerable analogy to the newly-patented machinery, by Messrs. Dennison and Harris, of Leeds, which we have now to describe.

*a* is a vessel containing the pulp, considerably diluted, which is preserved at the desired level by any of the usual means, so that the pulpy liquid, when the machine is at work, shall flow over the curved side of the vessel into a revolving cylindrical mould, *b*. In the vessel, *a*, a vane, *c*, is made to revolve to keep up a powerful agitation, and prevent any of the fibres from subsiding. The rotatory mould, *b*, is formed on its periphery like a sieve (which will hereafter be particularly described) and, as it turns round in the direction of the arrow, the pulp is received upon it; the chief part of the water instantly drains through the bars of the mould, and the paper, in a loose spongy wet state, is formed. The continued motion of the mould brings this pulpy matter in contact with an endless felt, *d*, which, by a superior attraction of cohesion, attaches to itself the pulpy fabric, and carries it forward between that felt, and another felt, *e*, where it receives pressure; first from a pair of *wet rollers*, *f f*, then a greater pressure from the *dry rollers*, *g g*: from thence the paper, in a comparatively dry state, is taken up by a rotatory vane, *h*, upon which it is folded; when this vane is fully charged it is removed, and another vane substituted in its place. In this manner a sheet of paper of any required length may be produced.

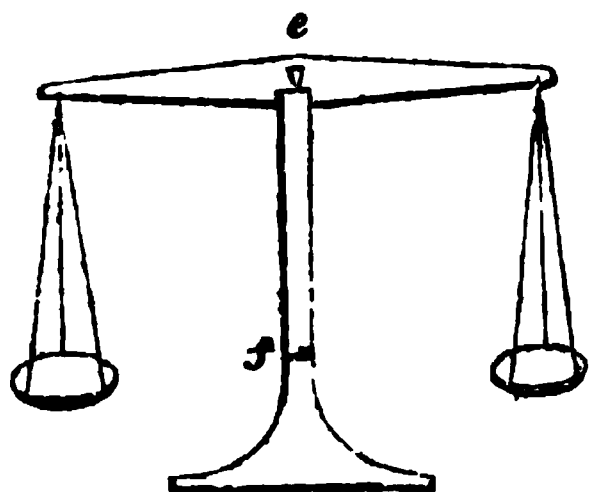
The cylindrical mould, *b*, revolves in a vessel of water, *i*, which serves to wash off the fibrous matter that may adhere to it, and to receive the water which drains from the diluted pulp as it passes over. The cast-iron frame upon which the mould revolves is jointed, to facilitate that lateral shaking, or trembling motion, essential in the making of paper, which is effected by a crank and rod, or by any of the other usual means, motion being communicated from the gearing which drives the rollers, &c.

The roller, *k*, is called the *combing roller*, as it takes the paper off the mould. This roller is provided with a regulating screw to tighten the web,\* or adjust the pressure against the mould. The upper *wet rollers*, *f*, and the upper *dry rollers*, *g*, have, also, regulating screws, by which they may be elevated or depressed in the long slots, wherein their axes revolve, so as to increase or diminish the pressure upon the wet paper. A small roller, *l*, is employed for assisting in separating the paper perfectly as it passes from the felt on to the vane, *k*. As the lowermost web becomes very wet by receiving the water from the paper, a small cylinder, *m*, is employed to press out the water from it as it revolves. For the perfect cleansing of the webs from the fibrous matter, small rotatory brushes are directed to be fixed so as to brush over their surfaces; and the employment of jets of water to wash over the felts is also recommended by the patentees.

In the arrangement of the several parts of this machine there is some degree of novelty, which the patentees claim as their invention; they also claim the peculiar construction of the rotatory mould. The external outline of this mould presents precisely the figure of a common drum; its periphery is formed by connecting together a series of metallic rings; the cylinder is then covered longitudinally with numerous small thin bars of copper,  $\frac{1}{8}$ ths of an inch wide, placed edgeways, so as to present a complete grating over the whole surface. The copper bars have numerous small lateral projections, to keep them at a regular distance apart: these are directed to be made by passing plain slips of copper between cylindrical steel rollers, with indentations on one of them adapted for producing an uniform series of little stubs.

### CHEAP AND DELICATE HYDROSTATIC BALANCE.

Let a slender beam of wood be procured, about eighteen or twenty-four inches long, and tapering a little from the middle to each end. Let a fulcrum of tempered steel, resembling the blade of a pen-knife, be made to pass through the middle of the beam, a little above the centre of gravity.



Similar steel blades are also made to pass through the ends of the beam for suspending the scales. The fulcrum rests on two small portions of thermometer tubes, fixed horizontally on the upright support *e f*. The support has a slit passing along the middle, to allow the needle at *e f* to play freely between the sides. A small scale made of card, and divided into any number of parts, is placed at *f*, for the purpose of ascertaining the point at which the needle remains stationary. This

\* For this purpose the screw appears to be put upon the wrong pulley.

balance possesses extreme delicacy. It may even be made more sensible than that belonging to the Royal Society of London.

I have said nothing of the perfect equality of the two ends, as this condition is not at all necessary to the accuracy of the balance, according to the method of double weighing. To ascertain the weight of any body, place it in one of the scales, and bring the needle to any point by means of small shot placed in the other scale; observe the point opposite to which the needle rests, or the middle between its extreme point of oscillation; remove the body, and put into the same scale as many known weights as will bring the needle to the same division as before. These weights will evidently be equal to the weight of the body, whether the arms of the balance be equal or not. This method of weighing is due to Borda.—*Brewster's Phil. Jour.*

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## PATENT WATER CLOSET BY J. DOWNTON,

BLACKWALL.

THIS very ingenious invention, though adapted to be used in a house, is especially calculated for ship-board; the soil being forced out of it by means of an air-pump, so that its perfect operation may be ensured in any situation, above as well as below the surface of the water.

A is the bason; B the air-pump, on the raising of the piston of which by means of the lever shewn, the soil is drawn into it from A through the bent tube; on depressing the piston in B the valve at the bottom of it closes, and a valve at C opens, through which the soil is driven, and along the pipe D to the required distance, the soil being prevented from returning by the closing of the valve at C.

In the upper part of the bason there is a small pipe leading into the upper part of the cylinder, where a valve opens inwards; consequently in depressing the piston, the foul air is drawn from the bason into the cylinder: and on raising the piston, the foul air is forced out of the cylinder by the large bent tube shewn, into the

discharge pipe D. To the pump lever the usual cranks are connected for turning on and off the clean water, supplied by the small pipe which is shewn bent round the cylinder.

### J. DOWNTON'S PATENT PUMP.

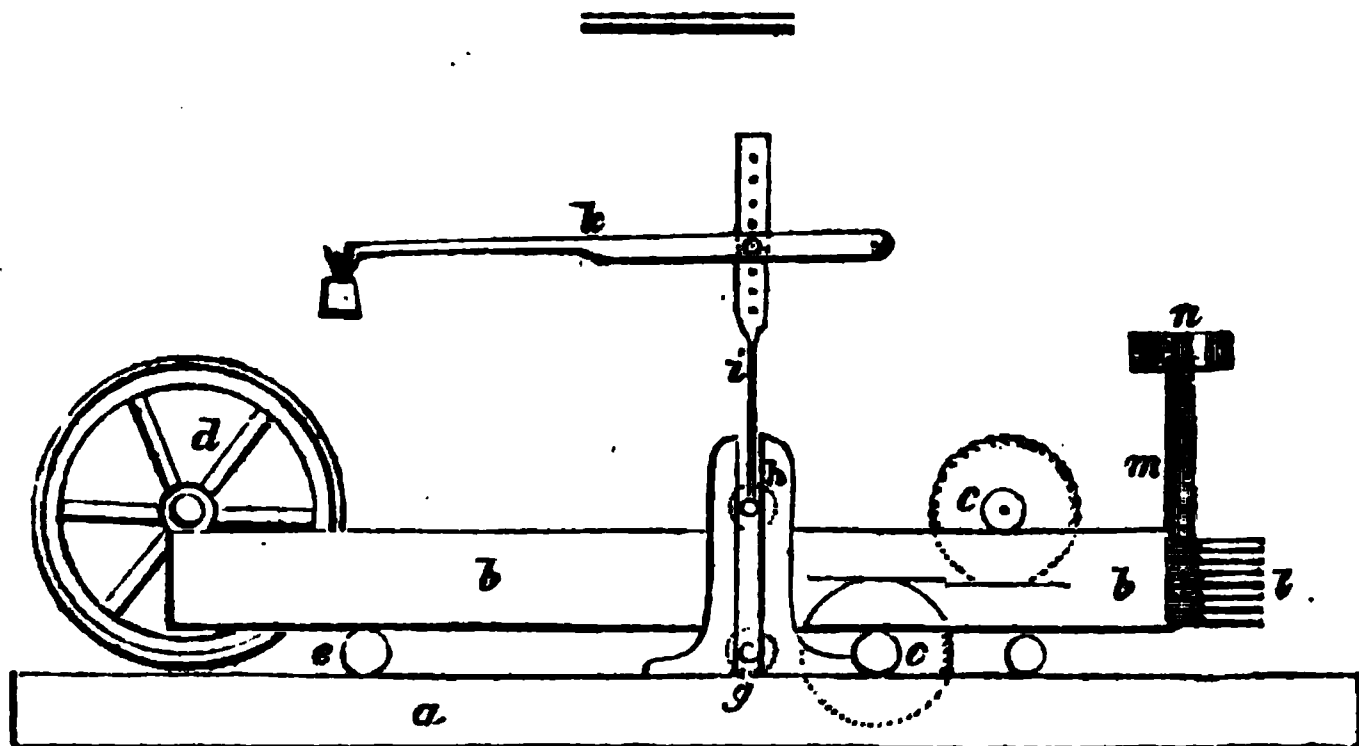
THE peculiar characteristics of this new hydraulic machine consist in its having *three buckets in one barrel or cylinder*, which are severally put into an alternating motion by means of revolving cranks, so that one of the buckets shall be always rising, and by that means produce a uniform and continued stream of water, without having recourse to the usual appendage of an air vessel, which the patentee considers as less advantageous; though we must confess that we do not ourselves discover the superiority of Mr. Downton's contrivance, while we are bound to admit its originality and great ingenuity.

The figure in the margin may be called a front elevation, a portion of the working barrel or cylinder being broken away to show the buckets, &c. *a* is the uppermost bucket or piston, the rod of which, *b b*, is hollow, and being connected to a bent arm, *d*, it is thereby attached to one of the limbs of a revolving three-throw crank *e*. The middle bucket, *f*, has also a hollow rod, *g g*, which being of smaller dimensions than the former, slides freely through it, and is connected to the crank, *e*, by another bent arm, *h*. The lowermost bucket, *i*, has a solid rod, *k k*, which passes entirely through the hollow rods of the other buckets, and attached directly to the middle of the crank. Upon each of the limbs of the crank are placed anti-friction wheels, working in elliptical slots at the upper end of each rod, by which the attrition of the rubbing surfaces is considerably reduced.

By this arrangement it will be seen that, on turning the crank by the winches, the buckets alternately receive and lift the water which has passed upwards through their valves. On raising the bucket, *i*, a vacuum is effected underneath, and the water rises from the main pipe, *l*, and fills the lower part of the cylinder; on the descent of *i* the water is received

above it through its valve; while  $i$  descends  $f$  rises, so that the water fills the space between the two; on the re-action of the bucket  $i$ , more water is received into the barrel from the main, while the upper bucket,  $a$ , operates upon the middle one,  $f$ , in the same manner as  $f$  has been described to operate upon  $i$ ; thus, by the simultaneous alternating motion of the three buckets or pistons, the water is discharged in one continuous stream.

The patentee considers this Pump as peculiarly applicable to ships, but that it may be also employed as a garden and fire-extinguishing engine, by simply attaching a hose to the nozzle; also, that it will be more effective than the ordinary machines for these purposes, requiring less manual labour. It is, perhaps, unnecessary for us to express our reasons for doubting these points, as they must be sufficiently obvious to every attentive reader.



### SAYNER AND GREENWOOD'S PATENT IMPROVED SAWING MACHINERY.

THE improvements in Saw-mills projected under this patent relate to three distinct particulars; each of them presumed to be an improved application of the circular saw.

The first and the most important consists in the employment of two circular saws instead of one, to cut through a piece of timber. According to the usual method, in sawing through a log of two feet in thickness, a circular saw of about five feet in diameter is required, as the cut cannot extend to the full semi-diameter of the saw, on account of its axis and the strengthening flange; but by the new arrangement of the patentees\* the operation is accomplished by two saws each of little more than half the diameter of the former; they

---

\* Mr. George Sayner, of Hunslet, Leeds, and Mr. John Greenwood, of Gomersall, Yorkshire.

are placed therefore on opposite sides of the timber, where each of them makes an incision rather more than half way through; the log is thus divided completely, effecting at the same time a very considerable saving in expense of power, and in the cost of saws.

The annexed diagram will, we trust, be found sufficient to explain the matter clearly: *a a* the bed of the saw-mill; *b b* the log of timber under operation; *c c* the two circular saws, the depths of their respective cuts being shewn by two fine lines; these saws have pulleys upon their axes, and are driven by bands which embrace them and the drum wheel *d*, motion being given to the latter by a water wheel, steam engine, or other power.

The timber rests and moves upon horizontal rollers *e e*, and is guided accurately to the saws by vertical rollers, (not shewn in the engraving), as usual in saw mills. The axes of the saws running in fixed bearings, the timber is forced against them by the propelling roller *f*, which is caused to revolve by another band from the drum wheel *d*, the axis of the roller being confined by the upright frame *g*: in the upper part of this frame is also situated the axis of the *pressing roller h*, which being connected to the vertical bar *i* is pressed upon by the weighted lever *k*; the roller *f* therefore gives the motion, and the roller *h* a steady firmness to the advancing position of the log.

If the timber is to be cut into planks, a number of circular saws are placed together on the axes of *c c*, with flanges between them of the thickness of the intended planks, and bolted together; by these means the whole log is at one operation formed into boards; and if it be required to cut the log into scantling or laths, a series of horizontal saws *l* placed in like manner, upon a vertical axis *m*, and driven by the pulley *n*, cuts the whole at once into those small divisions. This mode of applying the saws to work in a horizontal plane, so as to operate simultaneously with those acting in a vertical direction, is the *second particular* improvement alluded to at the commencement of this article.

The third improvement claimed is for uniting the plates of a series of saws closely together, so as to make one compact body of saws, without any interstices between them, for the purpose of reducing dye-woods entirely to saw dust, or powder, instead of the usual method of chipping or rasping them for the purposes of dyeing or other chemical operations.

---

## MASON'S PATENT AXLETREES AND BOXES.

Fig. 1 represents a perspective view of the axletree, with its principal appendages arranged in a line to show the mode of their application. Fig. 4 represents a longitudinal section of the axletree, with its several appendages screwed up into their respective places; and lying inclosed in the box peculiarly constructed for that purpose. Figs. 3 and 4 give sections of certain parts of the axletree and box, hereafter to be explained. The like letters refer to similar parts in each of the figures.



*a a* is the main part of the axletree, *b* a fixed shoulder, *c* a moveable shoulder, formed upon a metal collet, and rendered capable of being slid backwards and forwards, but not of turning round. This collet is adjusted and retained in any required situation, as will be presently shown: *d* is a screw formed upon the outer end of the axletree; *e* is a nut, hexagonal on the outside, and screwed in the inside to fit *d*. Around the inside of the hexagonal nut, *e*, are formed at equal distances, and longitudinally, six semi-circular grooves, (as partly shown in fig. 1,) but more distinctly exhibited in the section, Fig. 2; the screw, *d*, has likewise two similar grooves cut through its thread, one of which is seen in Fig. 1, and both of them in Fig. 2. By this arrangement it will be perceived that a power is obtained of giving an increased or a decreased play of the wheel upon the axle, adapting it thereby to the state or quality of road, over which it has to travel: and in order to fix this nut into the required position, a cylindrical pin which is rivetted to the hexagonal plate, *f*, is inserted into one of the holes formed by the union of two of the opposed semi-circular grooves, which entirely prevents any rotation or movement of the nut as long as the pin remains in the hole. To prevent this pin from coming out, a collar of leather or other compressible substance, *g*, is first put on the long hexagonal-headed screw, *h*, when the latter being screwed into the internal screw of the axletree (seen at *i*, Figs. 2 and 4) the whole is thus made fast.

Having now described the axletree, it remains for us to explain the construction of the box, which we have put in section in its

proper place around the axletree in Fig. 4. The principal novelty consists in the contrivances made in it, for affording a plentiful supply of oil, or other lubricating matter, to the axletree in every part, as well as for retaining any sand, gravel, &c. which may get between them. *k k k k* show the cylindrical parts of the box, with a cap, *l l*, screwed upon its outer extremity, which serves to contain oil for lubricating those parts of the axletree that are contiguous; *o o* are long grooves, also for oil; two of these are brought into view in the *longitudinal* section, Fig. 4; but there are four of them, as may be seen in the *transverse* sectional Fig. 3; which section is made where the dotted line divides Fig. 4; *p p* are two other reservoirs for oil.

Want of room, owing to the pressure of other valuable matter, obliges us to be rather more brief in our description of this admirable improvement in axletrees, than we should otherwise have been inclined. We believe, however, we have not omitted to notice any point of importance, which will not readily suggest itself to the reader, after a careful inspection of the figures. Suffice it, therefore, on our part to observe, that these improvements are adapted not only to wheel carriages, but to a variety of other machines; the patentee and manufacturer, is Mr. William Mason, of N<sup>o</sup>. 23, Castle Street East, Oxford Street, London.

## IMPROVED METHOD OF CALCULATING TABLES.

*To the Editor.*

SIR,

IN my last (I do not recollect the date) I communicated to you the method of calculation made use of for the first part of my little work of "TABLES OF THE AREAS AND CIRCUMFERENCES OF CIRCLES, &c." which I hope, ere this, you have had the goodness to lay before the public, as my great distance from town not enabling me to obtain the *Register of Arts and Sciences* oftener than once a month, prevents me from knowing for a certainty whether it has been inserted or not. In that letter, however, I promised to resume the subject, which I now do by giving you a detail of the process of calculation made use of for the second and third parts of the work alluded to above.

I observed that the calculation of the *second* part was attended with rather more trouble than the first, by reason of several of the fractional parts of a foot with which I had to deal, running out to recurring decimals, which was not to affect the operation within the limits of those decimals to be recorded in the tables. To accomplish this I made some very tedious experiments, stimulated by the conviction that to obtain this point in a clear and satisfactory manner, would add much to the importance and utility of the method of calculation I had discovered.

At first I took the respective diameters of a circle,  $1.08333 + 1.16666$ , &c.  $1.25$ , and  $1.3333$ , &c. respectively, equal to  $1\frac{1}{2}$ ,  $1\frac{1}{2}$ ,

$1\frac{1}{2}$ , and  $1\frac{1}{4}$ , which I squared and multiplied by .7854, the reputed area of a square inch, for their respective areas. These areas I subtracted one from the other, and their remainders one from the other, to obtain the requisite *signs fluent and constant*. But this method not affording me satisfaction enough, because the signs did not come out without a very considerable remainder, I tried another method, which was to take the *areas of the above circles in inches*, and divide them by 144, the number of square inches in a square foot, for the square feet and decimal parts of a foot therein contained. With these quotients I proceeded as usual, i. e. to subtract them one from the other, and their remainders one from the other, till *nothing remained*; which furnished me with signs correct enough, with a little modification, to answer my purpose. The following is an example in detail of this latter method.

Part Second commences with the area of a circle whose diameter is equal to a foot, a regular advance of one inch being made upon this diameter up to 50 feet : wherefore the

1st diam = 12 inches.

```

12
---
144
-7854
---
576
720
1152
1008
144)113-0976(-7854 seq. log.
1008
---
1230
1152
---
777
720
---
576
876
---

```

the 2nd. 13 inches

```

13
---
39
13
---
169
-7854
---
676
845
1353
1183
144)132-7326(-921754166 Sec. area of 1 1/2
1296
---
313
288
---
263
144
---
1086
1008
---
780
720
---
600
576
---
240
144
---
960
864
---
960
864
---
864
&c.

```

the 3rd. 14 inches

$$\begin{array}{r}
 14 \\
 \hline
 56 \\
 14 \\
 \hline
 196 \\
 -7854 \\
 \hline
 784 \\
 980 \\
 1568 \\
 1372 \\
 \hline
 144)153.9384(10690166 \text{ \&c. area of } 1\frac{2}{3} \\
 144 \\
 \hline
 993 \\
 864 \\
 \hline
 1298 \\
 1296 \\
 \hline
 240 \\
 144 \\
 \hline
 960 \\
 864 \\
 \hline
 960 \\
 864 \\
 \hline
 \text{\&c.}
 \end{array}$$

And the 4th. 15 inches

$$\begin{array}{r}
 15 \\
 \hline
 75 \\
 15 \\
 \hline
 225 \\
 -7854 \\
 \hline
 900 \\
 1125 \\
 1800 \\
 1575 \\
 \hline
 144)176.7150(1.2271875 \text{ area of } 1\frac{2}{3} \\
 144 \\
 \hline
 327 \\
 288 \\
 \hline
 391 \\
 288 \\
 \hline
 1035 \\
 1008 \\
 \hline
 270 \\
 144 \\
 \hline
 1260 \\
 1152 \\
 \hline
 1080 \\
 1008 \\
 \hline
 720 \\
 720 \\
 \hline
 \text{\&c.}
 \end{array}$$

Now taking those quotients respectively as the areas of  $1 = .7854$  of  $1\frac{1}{2} = .921754166$ , of  $1\frac{2}{3} = 1.0690166$ , &c. of  $1\frac{3}{4} = 1.2271875$ , and subtracting them one from the other, and their remainders one from the other till nothing remain (which in this case can be done), we shall obtain the requisite signs fluent and constant; thus—

|                                     |                                      |                                          |
|-------------------------------------|--------------------------------------|------------------------------------------|
| $.921754166$ area of $1\frac{1}{2}$ | $1.069016666$ area of $1\frac{2}{3}$ | $1.227187500$ area of $1\frac{3}{4}$     |
| $.7854$ seq. log.                   | $.921754166$ ditto $1\frac{1}{2}$    | $1.069016666$ ditto $1\frac{2}{3}$       |
| $.136854166$ sign fluent            | $.147262500$                         | $.158170834$                             |
|                                     | $.136854166$ sign fluent             | $.147262500$                             |
|                                     | $.010908334$ sign const.             | $.010908334$ sign const. } $\frac{2}{3}$ |
|                                     |                                      | $.010908334$ sign const. } $\frac{1}{2}$ |

Then taking the area of  $1 = .7854$ , as the *sequent seriamic logarithm*, or the *logarithm of the series*, and proceeding as directed in my former letter, we shall obtain a series of the areas of circles, whose diameters are advanced by  $\frac{1}{2}$ , *ad infinitum*, agreeable to the following example.

Note, however, that the figure in the sign fluent, and in the area opposite the asterisks (i. e. the figure 2), is omitted in the process of addition, which obviates in a great measure the precision wanted in the sequent logarithm and its signs; causes a distinct repetition or recurrence of the decimals on the right hand of the vertical line up the middle of the column previously noticed, and subjects the process of calculation to that abridgement of labour and figures indicated by

the lower extremity of the column ; and hence the same advantage, if not a much greater one, over the original method of squaring the diameter, &c. is obtained in calculating this second part of my work, as was obtained in calculating the first.

| Diam.  |                            | Diam.            |                        |
|--------|----------------------------|------------------|------------------------|
| •7854  | Sequent log. 1             | 3•9760           | 87502* 2 $\frac{1}{2}$ |
| •1863  | 54166 sign fluent.         | •2099            | 79168                  |
| •0109  | 08334 sign constant        | •0109            | 08334                  |
| •9217  | 54166 area 1 $\frac{1}{2}$ | 4•2760           | 66668 2 $\frac{1}{2}$  |
| •1472  | 62500 sign fluent          | •3108            | 87502*                 |
| •0109  | 08334 sign constant        | •0109            | 08334                  |
| 1•0690 | 16668 1 $\frac{1}{2}$      | 4•5869           | 54168 2 $\frac{1}{2}$  |
| •1581  | 70834                      | •3217            | 95835                  |
| •0109  | 08334                      | •0109            | 08334                  |
| 1•2271 | 87500 1 $\frac{1}{2}$      | 4•9087           | 50002* 2 $\frac{1}{2}$ |
| 1•690  | 79168                      | •3327            | 04167                  |
| •0109  | 08334                      | •0109            | 08334                  |
| 1•3962 | 66668 1 $\frac{1}{2}$      | 5•2414           | 54168 2 $\frac{1}{2}$  |
| •1799  | 87502*                     | •3436            | 12502*                 |
| •0109  | 08334                      | •0109            | 08334                  |
| 1•5762 | 54168 1 $\frac{1}{2}$      | 5•5850           | 66668 2 $\frac{1}{2}$  |
| •1908  | 95834                      | •3545            | 20834                  |
| •0109  | 08334                      | •0109            | 08334                  |
| 1•7671 | 50002* 1 $\frac{1}{2}$     | 5•9395           | 87502* 2 $\frac{1}{2}$ |
| •2018  | 04168                      | •3654            | 29168                  |
| •0109  | 08334                      | •0109            | 08334                  |
| 1•9689 | 54168 1 $\frac{1}{2}$      | 6•3050           | 16668 2 $\frac{1}{2}$  |
| •2127  | 12502*                     | •3763            | 87502*                 |
| •0109  | 08334                      | •0109            | 08334                  |
| 2•1816 | 66668 1 $\frac{1}{2}$      | 6•6813           | 54168 2 $\frac{1}{2}$  |
| •2236  | 20834                      | •3872            | 45834                  |
| •0109  | 08334                      | •0109            | 08334                  |
| 2•4052 | 87502* 1 $\frac{1}{2}$     | 7•0686           | 00002* 3               |
| •2345  | 29168                      | •3981            | 5                      |
| •0109  | 08334                      | •0109            | 0                      |
| 2•6398 | 16668 1 $\frac{1}{2}$      | 7•4667           | 5 3 $\frac{1}{2}$      |
| •2454  | 87502*                     | •4090            | 6                      |
| •0109  | 08334                      | •0109            | 0                      |
| 2•8852 | 54168 1 $\frac{1}{2}$      | 7•8758           | 1 3 $\frac{1}{2}$      |
| •2563  | 45834                      | •4199            | 7                      |
| •0109  | 08334                      | •0109            | 0                      |
| 3•1416 | 00002* 2                   | 8•2957           | 8 3 $\frac{1}{2}$      |
| •2672  | 54168                      | •4308            | 7                      |
| •0109  | 08334                      | •0109            | 0                      |
| 3•4088 | 54168 2 $\frac{1}{2}$      | 8•7366           | 6 3 $\frac{1}{2}$      |
| •2781  | 62502*                     | &c. ad infinitum |                        |
| •0109  | 08334                      |                  |                        |
| 3•6870 | 16668 2 $\frac{1}{2}$      |                  |                        |
| •2890  | 70834                      |                  |                        |
| •0109  | 08334                      |                  |                        |

And when the most simple state of this logarithmic method is compared with the most simple state of the original method, for the same degree of accuracy, the superiority of the one over the other cannot but be most strikingly apparent.

(TO BE CONTINUED.)

**History of the Steam Engine, Chap. IV.***Continued from p. 256.*

To explain the manner in which the diaphragms are wrought upon when in their proper place, let *Fig. 2* represent one end of the hollow cylinder or drum, and the central circles exhibit the hollow tubes or axles already explained. The two diverging parts are the ends of the diaphragms, and are packed as before mentioned; now, these diaphragms are hollow within, and if we consider one of them to be constantly supplied with steam by means of the hollow tube to which it is connected, and the other continually holding communication with the condensing water, the consequence will be, when steam is admitted through a valve into the lesser apartment of the drum, and another valve open from the empty diaphragms into the larger apartment, that the diaphragms will recede from each other, with all the force of the steam between them; but if, by proper prevention, they can move only in one direction, it is plain that the one will remain stationary till overtaken by the other; their junction will then shift the valves into contrary positions by means of the prominent parts in them for that purpose, and the apartment, before filled with steam, instantly becoming empty, the diaphragm which was before stationary now becomes active, and the momentum of the former may, in effect, be considered as transferred to the latter. There being, therefore, in these parts of the machine a continual motion, by rapidly succeeding each other in a circular direction, their respective axles on which they turn, and which communicate motion to other machinery without the drum, are influenced in the same manner, agreeable to the main principles herein primarily set forth.

In order that the steam shall have a power of turning the diaphragms only in one direction; let *Fig. 1* represent one of the lids of the drum, having the side that is faced true on the opposite direction to that exhibited in the drawing; in this is a circular channel, *G G*, and a projecting ring *P*, which serves as a perpetual fulcrum to support the two levers, *C D*, that occasionally revolve in the channel, and act as detents. The outer boundary of the channel also acts as a fulcrum to the extremity of the two levers at their thick ends; so that, when they are acted upon, from their connection with the axles turning them to the right hand, by means of a strong collar *E*, there will be no impediment to their freely revolving in the circular channel; but, when the axles strain upon the small ends of the levers in a contrary direction, they instantly become fixed so firmly between the two boundaries of the channel, as effectually to resist the whole force of the machine. To provide against the least retrograde motion whatever, when the levers may be partly worn from friction, they are furnished with springs between them and the outer extremity of the channel, so that the two bearing points may at least touch their respective fulcrums.\*

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\* Specification of Patent.

This was Hornblower's rotatory engine. It, too, as we shall shew, has been patented as an original invention many years subsequently to the date. It would be no unnecessary digression to shew here the necessity of some work which contained a chronological description of anything which has been attempted (and howsoever insignificant) in the form of steam engines. In the Repertory of the Arts there has, from the commencement, been inserted a description of most professed improvements on the steam engine; but this work is too scarce, too voluminous, and too expensive, to be in the hands of many.

The objection to this machine appears to be that the two diaphragms *c* would soon destroy each other; for whilst one remained stationary, the other, having no check, would strike forcibly against it: now to retard this check would be to produce an irregular motion, because as the motion is communicated directly to the external machinery, any decrease in the speed of the diaphragm would also produce a decrease of speed in the machine throughout: and if the speed of the diaphragm be kept up it would strike violently against that one which is at rest.

Mr. Matthew Murray, of Leeds, a gentleman, whose name will be familiar to most of our readers as a steam engine manufacturer of celebrity, obtained a patent, in 1799, for saving fuel and lessening the expense of engines. He proposed to effect the first object, by having a small cylinder upon the boiler, to which he fitted a piston and rack: this rack worked a wheel upon a spindle, which spindle passed through the chimney, where was a damper, which had free liberty to turn round. As the steam increased in the boiler beyond the necessary force, it forced up this piston and rack, which acting upon the spindle, closed or partially closed the damper, and thereby lessened the draught of the fire, by which the consumption of the coal was reduced, until the superfluous steam was wrought out of the boiler, when a weight, which had been wound up by the rise of the piston, descended, and allowed the damper to return to its former position.

The other object, namely, decrease of cost, will be better elucidated by the words of the specification. "I cause the steam or atmosphere to act upon pistons moving in long pipes or cylinders, lying in a horizontal direction. These pipes may be square or round, and of any length required, but must lie in a horizontal direction, which is the principle here stated. By which contrivance, a more convenient motion can be applied to mill work, and a much longer stroke can be obtained than in the usual way.

"Next. I cause the pistons moving in the above pipes or cylinders, by their reciprocating motion, to produce a circular or rotative motion of equal power, by means of screws, racks, and wheels, applied in such a manner as to cause the power of the engine to fix alternately the wheels necessary for producing motion, in perpendicular or horizontal directions."

*Fig. 1 and 2*, two horizontal cylinders, containing pistons; *M M* the piston rods. *Figs. 1 1*, inlets for the steam from the boiler and

atmosphere; 2 2, outlets for the condensed steam or atmosphere; N, a roller for bearing the piston. These pipes or cylinders must be firmly fixed down to a stone platform, or iron cistern, or any kind of firm and secure fixing.



M

O (*Fig. 1 and 2*) is a rack, fixed to the piston rod M, and moving upon the roller P; Q is a socket wheel with teeth, working in the rack O; the inside of the socket wheel Q is screwed to fit the middle of the axletree; R 1 and R 2, (*Fig. 1.*) are plain wheels, put loose on the square of the axletree; at S 1 and S 2, are tooth wheels, put loose upon the round part of the axletree. T T, are plain wheels, acting as abutments, put fast upon the axletree. On an axletree or rotative shaft, for giving motion to the mill work, are fixed the wheels V and W; X a small fly wheel, for regulating the motion.

Now the effect or motion of this machine is, that when the piston, and piston rod, and rack O, are impelled by the steam or atmosphere in the direction of the arrow, the socket wheel Q, turns upon the screwed part of the axletree, and with its ends, presses (by the force or power of the engine) the loose wheel S 1 between the wheels R and T, by which means, the wheel V is turned with the same velocity as the screwed wheel Q, while the wheel S 2 is at liberty upon the axle; in which situation the whole continues, till the piston arrives at the end of the long pipe or cylinder, when the piston is changing motion and going in the contrary direction to the arrow, the rack O turns the wheel Q in the opposite direction, sets at liberty by the former means the wheel S 1, and fastens the wheel S 2, which gives the same motion to the wheel W, by means of the intermediate wheel B.\*

---

\* Repertory of the Arts.

#### LIST OF NEW PATENTS SEALED.

LACE.—To John Riste, of Chard, Somersetshire, for improvements in machinery for making bobbin-net, &c.—October 4th. Six months to enrol specification.

BOOTS.—To F. Halliday, of Ham, Surrey, for an improved apparatus for drawing boots on and off.—October 4th. Six months.

CARRIAGE-WHEELS.—To Theodore Jones, of Coleman Street, London, for an improvement in carriage-wheels.—October 11th. Six months.

FIRE-ARMS.—To William Mills, of Hazlehouse, Bisley, Gloucestershire, for an improvement in fire-arms.—October 18th. Six months.

PRINTING.—To William Church, of Birmingham, for improvements in printing.—October 18th. Six months.

FURNITURE.—To Samuel Pratt, of New Bond Street, for improvements in beds, bedsteads, chairs, &c.—October 18th. Six months.

NAVIGATION.—To William Busk, of Broad Street, for improvements in propelling boats, ships, &c.—October 18th. Six months.

CARRIAGES AND SHIPS.—To Colonel James Vincy, of Shanklin, Isle of Wight, for improvements in the construction of carriages, and the application of a power hitherto unused for that purpose to draw the same, which power is also applicable to the drawing of ships and other vessels, and for raising weights, &c.—October 18th. Six months.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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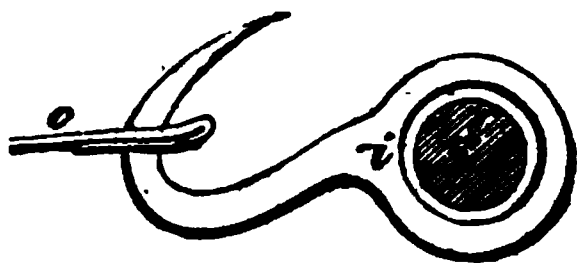
BURNETT'S PATENT DRAG SHEETS.

## BURNETT'S\* PATENT DRAG-SHEETS,

FOR LESSENING THE DRIFT AND DANGER OF VESSELS AT SEA  
IN GALES OF WIND.

THE objects of this invention are clearly expressed in the above title; and as there can be but one opinion of their importance, it is with peculiar pleasure that we become the medium of communicating to the public the very simple and convenient means proposed by the patentee for effecting them. It may be said that our knowledge in nautical affairs is too limited to justify us in speaking confidently upon an invention of the nature in question; but, looking at it as mechanics, we may be allowed the satisfaction of expressing our sanguine expectations of its useful application, and of earnestly recommending it to a fair trial.

The upper figure in the frontispiece represents the drag-sheet, viewed a little in perspective; *a* is a plank, hollowed out underneath, so as to form a cavity of sufficient dimensions to receive the remainder of the apparatus when rolled up, thus affording convenient portability and means of stowage. When in use this plank forms the *float* for the rest of the apparatus appended to it, and sunk in the water; *b* is a circular bar or rod of metal firmly fixed at the extremities to the float, within the cavity before mentioned; round this bar the upper side of a square piece of sail-cloth, *c*, is fastened; the lowermost side is in like manner secured to another circular metallic bar or roller *d*; the extremities of *d* are formed into rings or eyes, through which are linked the rings, *e e*, of two vertically suspended rods, *f f*; the upper ends of *f f* are formed also into eyes, which are thereby hung upon hooks attached to the uppermost bar *b*: a series of eye hooks, like the one delineated in the margin (at *i*) sliding upon the rods *f*, are then employed to stretch the canvass, *c*, out tightly between them. The frame thus completed a rope or chain is attached to each corner of it, one from *e* to *g* on the one side, and another chain in the same manner on the opposite side; both of these pass through a ring *h*, as represented, which ring is attached to a hawser or cable, that is, made fast to the bow of a ship. By this arrangement the heaving of the vessel or of the drag, by the undulatory motion of the waves, allows the ring to traverse up and down upon the chains, preserving thereby the perpendicularity of the drag, and consequently producing the utmost resistance to its passage through the water. One, two, or more of these drags, may be employed at a time, as the occasion may require.



In annexing a slight pictorial representation of the manner of using the drag, by the underneath figure of the frontispiece, we trust that we have not mistaken the views of the patentee. Our intention was to exhibit a vessel off a lee shore in a heavy gale of wind, with two drags thrown out; the effect of these, it will be perceived, must be very considerable in retarding the progress of the vessel astern:

\* William Shelton Burnett, Esq. of London Street.

For it should be borne in mind, that the drags being wholly immersed in the water, the wind can have no effect upon them; therefore, by opposing their broad surfaces against the water at right angles to the pull of the vessel, the head of the latter is held against the wind; in which position the effect of the gale upon the vessel is very materially reduced, and the heads or curls of the sea will be broken before striking the vessel by the interposition of the floats; and thus, in some manner, the drags will answer in effect, that of a floating break-water, and likewise that of an anchor. How often do we hear of a vessel *falling off from the wind and sea* when laying to, having every thing cleared from the deck by a sea falling aboard, and sometimes to the causing of her *total destruction*! We do not presume to say that a ship can *always* be saved from injury or wreck by the use of Mr. Burnett's drags, but we anticipate the ready acquiescence of every seaman, that their employment is calculated to materially reduce, and frequently to ward off the danger entirely.

From their great simplicity and compactness, and we presume their trifling cost, it is with great satisfaction that we are enabled to discover any obstacle to their becoming appendages of the highest utility and importance to every sea-going vessel.

### RYDER'S PATENT APPENDAGES TO CARRIAGE POLES.

THE object attained by this invention is a means of easily and firmly fixing the poles to carriages, and, when required, of readily releasing them therefrom, great inconvenience having heretofore been experienced by the poles sticking too fast in wet weather; occasioning thereby a premature destruction to those parts. The new arrangement of the patentee is distinguished for great simplicity and strength, and consequent durability.

*a* is the pole of the carriage, *b* the splinter bar, *c c* the fetchels, *d* part of the wooden axle-tree. An iron frame, *e e*, is fixed between the fetchels; in the front of this iron frame there is a proper aperture to receive the tapered part of the carriage pole; and another of less dimensions at the back, to receive the extreme end, which is shod with an iron bolt for that purpose, this bolt or pin is fixed on the extremity of the pole by two long straps which clasp the top and the

bottom, and have bolts passing through both. When the pole is inserted into its place, it is secured there by turning the screw *f*, which forces two iron wedges into recesses made in the frame; from whence they cannot be withdrawn, or the pole be detached, but by turning the screw *f* the reverse way.

### WINCH'S PATENT ROTATORY PUMP.

THE improvements introduced by the patentee, (Mr. Robert Winch, Engineer, of Stewart's Buildings, Battersea Fields,) consist chiefly in the application of certain *catch-hooks*, to prevent the flaps or pistons of rotatory pumps, from rubbing too hard against the circular sides of the cylinder; in providing cavities between the arms of the revolving centre wheel, for the reception of gravel and other solid matters that may be thrown into the cylinder; and by a peculiar modification of the same invention, in the construction and adaptation of rotatory arms, for closing the valves as they successively pass under their operation.

In the margin is delineated a vertical section of a rotatory pump, without the last mentioned appendage of the rotatory arms for closing the valves

*a a* is the cylindrical case shewing the ends of the bolts by which it is connected to the two circular side plates; *b* the rising main pipe from the well, *k k k* the water way, *c* the discharge pipe, *d* is a circular box, turned round upon the hexagonal shaft in the centre, by a wheel on the outside of the pump case: to the periphery of this circular box the flap pistons, *g g g g*, are fixed by joints, and as they revolve they are closed by coming in contact with the 'circular inclined plane,' *e e*, the underside of which forms a stop to the upward course of the water on that side of the cylinder.

On passing the curved piece, *e*, the pistons successively fall open, with their edges touching the interior surface of the pump case; the water which has passed up from the main pipe through the valves *ii*, and occupied the spaces marked *h h h*, is then carried forward by the pistons as they revolve, and is discharged in a continuous uniform stream at *c*.

To prevent the pistons from striking violently against the cylinder as they fall against it, as well as to avoid any undue attrition of these parts, the catch hooks, *h h h h*, are employed; the action of these is so manifest in the diagram as to need no further description. To facilitate the shutting of the pistons as they come in contact with the curved piece, *e*, each of them have a second joint in the middle as delineated. This contrivance appears defective, and open to many objections, which the attentive reader will not fail to notice; the patentee himself seems to have been aware of it, by his showing in the drawings attached to his specification another modification of the pump, wherein a rotatory vane is employed for closing the valves in succession; but this arrangement renders it necessary to have a toothed wheel fixed to the axis of the circular box, to work a pinion on the axis of the rotatory vane, that the motion of the latter may always correspond with that of the pistons.

#### IMPROVED METHOD OF MAKING CHARCOAL IN THE LARGE WAY.

An improved method of making charcoal in the large way, has been devised by Mr. Bull. It consists in surrounding the pieces of wood to be charred with pulverized coal, by which a product is afforded, equal in every respect to that made in cylinders, or retorts of iron. Besides an improvement in quality, the quantity obtained is much greater than in the ordinary method. It occurred to Mr. Bull during his experiments, that an important improvement might be made in the common process, by filling the interstices between the sticks of wood with the culm or fine coal, left on the ground after the large coal has been drawn from the pit. In this way is prevented the access of air, which, when it takes place, not only destroys a large portion of the charcoal, but renders what remains less valuable. A charcoal-burner of New Jersey, who made some in this method, found the product to be about ten per cent. more in quantity by measure, than he had ever before obtained from the same kind and quantity of wood, and the coal when brought to market was nearly 20 per cent. heavier than usual. The coal had been well charred, and lost very little in weight by ignition in powdered charcoal. The quality was considered as superior to any other ever offered in that market; it was as cleanly to handle as anthracite coal, and sold readily at an advanced price.—*Franklin Journal*.

## IMPROVED METHOD OF CALCULATING TABLES

*Continued from p. 268.*

The column of areas in inches, where the advance upon the diameter is the integer 1, was obtained simply as follows,—Diam. of

| 1st circle 12 inches | of 2nd 13 inches. | of 3rd 14 inches | of 4th 15 inches    |
|----------------------|-------------------|------------------|---------------------|
| 12                   | 13                | 14               | 15                  |
| 144                  | 39                | 56               | 75                  |
| 7854                 | 13                | 14               | 15                  |
| 576                  | 169               | 196              | 225                 |
| 720                  | 7854              | 7854             | 7854                |
| 1302                 | 676               | 784              | 900                 |
| 1008                 | 845               | 980              | 1125                |
| 113-0976 seq. log.   | 1352              | 1568             | 1800                |
|                      | 1183              | 1372             | 1575                |
|                      | 132-7326 area     | 153-9384 area    | 176-7150 area       |
|                      | 113-0976          | 132-7326         | 153-9384            |
|                      | 21-2058           | 21-2058          | 22-7764             |
|                      | 19-6350 s. f.     | 19-6350          | 21-2058             |
|                      |                   | 1-5708 s. c.     | 1-5708 s. c. } prop |
|                      |                   |                  | 1-5708 s. c. }      |

Then proceeding as usual with these signs, the model was this:—

|                       |    |               |    |
|-----------------------|----|---------------|----|
| 113-0976 sequent log. | 12 | 226-9806      | 17 |
| 19-6350 sign fluent   |    | 27-4890       |    |
| 1-5708 sign constant  |    | 1-5708        |    |
| 132-7326 area         | 13 | 254-4696      | 18 |
| 21-2058 sign fluent   |    | 29-0598       |    |
| 1-5708 sign constant  |    | 1-5708        |    |
| 153-9384              | 14 | 283-5294      | 19 |
| 22-7764               |    | 30-6306       |    |
| 1-5708                |    | 1-5708        |    |
| 176-7150              | 15 | 314-1600      | 20 |
| 24-3474               |    | &c.           |    |
| 1-5708                |    | ad infinitum. |    |
| 201-0624              | 16 |               |    |
| 25-9182               |    |               |    |
| 1-5708                |    |               |    |

In obtaining the *circumferences* of circles for this Third Part, i. e. for the circumferences of those circles whose diameters advance by one inch, or the integer 1, I proceeded thus:—

|                           |                  |                        |
|---------------------------|------------------|------------------------|
| 3-1416 circum. of 1       | 3-1416           | 3-1416                 |
| 12 diam. of 1st circle    | 13 diam. of 2nd, | 14 diam. of 3rd,       |
| 37-0992 sequent logarithm | 94248            | 125664                 |
|                           | 31416            | 31416                  |
|                           | 40-8408          | 43-9824                |
|                           | 37-0992          | 40-8408                |
|                           | 3-1416 s. c.     | 3-1416 sign const. } x |
|                           |                  | 3-1416 sign const. } x |

Then proceeding as usual with those signs, the model was this :—

|                      |    |               |    |
|----------------------|----|---------------|----|
| 37.0992 sequent log. | 12 | 53.4072       | 17 |
| 3.1416 sign constant |    | 3.1416        |    |
| 40.8408 circum.      | 13 | 56.5488       | 18 |
| 3.1416 sign constant |    | 3.1416        |    |
| 43.9824 &c.          | 14 | 59.6904       | 19 |
| 3.1416               |    | 3.1416        |    |
| 47.1240              | 15 | 62.8320       | 20 |
| 3.1416               |    | &c.           |    |
| 50.2656              | 16 | ad infinitum. |    |
| 3.1416               |    |               |    |

Now the other column of circumferences given in feet and parts of a foot, was calculated in the following manner;—

|                                           |                                           |           |                                      |
|-------------------------------------------|-------------------------------------------|-----------|--------------------------------------|
| 3.1416—seq. log.                          | 3.1416                                    | 3.1416    | 3.1416                               |
|                                           | 13 diam. of 2nd circle                    |           | 14 diam. of 3rd circle               |
|                                           | <u>94248</u>                              |           | <u>125664</u>                        |
|                                           | <u>31416</u>                              |           | <u>31416</u>                         |
| 12)40.8408(3.4034 circ. of $1\frac{1}{2}$ | 12)43.9824(3.6652 circ. of $1\frac{1}{2}$ |           |                                      |
| 36                                        | 3.1416 seq. log.                          | 36        | 3.4034 ditto of $1\frac{1}{2}$       |
| <u>48</u>                                 | <u>•2618</u> sign const.                  | <u>79</u> | <u>•2618</u> s. con. } $\frac{1}{2}$ |
| 48                                        | <u>      </u>                             | 72        | <u>•2618</u> s. con. } $\frac{1}{2}$ |
| <u>40</u>                                 |                                           | <u>78</u> |                                      |
| <u>36</u>                                 |                                           | <u>72</u> |                                      |
| <u>48</u>                                 |                                           | <u>62</u> |                                      |
| <u>48</u>                                 |                                           | <u>60</u> |                                      |
| <u>      </u>                             |                                           | <u>24</u> |                                      |
|                                           |                                           | <u>24</u> |                                      |

|                     |    |        |    |
|---------------------|----|--------|----|
| 3.1416 sequent log. | 1  | 5.7596 | 1½ |
| •2618 sign constant |    | •2618  |    |
| 3.4034 circum.      | 1½ | 6.0124 | 1½ |
| •2618 sign constant |    | •2618  |    |
| 3.6652              | 1½ | 6.2832 | 2  |
| •2618               |    | •2618  |    |
| 3.9270              | 1½ | 6.5450 | 2½ |
| •2618               |    | •2618  |    |
| 4.1888              | 1½ | 6.8068 | 2½ |
| •2618               |    | •2618  |    |
| 4.4506              | 1½ | 7.0686 | 2½ |
| •2618               |    | •2618  |    |
| 4.7124              | 1½ | 7.3304 | 2½ |
| •2618               |    | •2618  |    |
| 4.9742              | 1½ | 7.5922 | 2½ |
| •2618               |    | •2618  |    |
| 5.2360              | 1½ | 7.8540 | 2½ |
| •2618               |    | •2618  |    |
| 5.4978              | 1½ | 8.1158 | 2½ |
| •2618               |    | •2618  |    |

|                 |                  |                             |                  |
|-----------------|------------------|-----------------------------|------------------|
| 8-3776<br>-2618 | 24 $\frac{1}{2}$ | 9-1630<br>-2618             | 24 $\frac{1}{2}$ |
| 8-6894<br>-2618 | 24 $\frac{1}{2}$ | 9-1248<br>&c. ad infinitum. | 3                |
| 8-9012<br>-2618 | 24 $\frac{1}{2}$ |                             |                  |

Note.—The column in the Tables to which this calculation properly belongs, was altered at the desire of a friend. Instead of the results being given in feet and decimal parts, it is given in feet, and the remaining part of a foot in inches.

I now, sir, proceed to the third and last part of the body of the work under present consideration; and in going through this part I shall be very brief, not considering it needful to be otherwise, as the principle of calculation is the same, and as so much has already been done to explain it, I shall merely give the form of obtaining the signs, with a slight model of the logarithmic method; observing previously, that the advance upon the diameters of the circles in this part is one-tenth. 7854=seq. log. whose diameter is 1 for the areas of circles.

| 1-1 diam.<br>1-1   | 1-2 diam.<br>1-2   | 1-3 diam.<br>1-3   |
|--------------------|--------------------|--------------------|
| 7854               | 7854               | 7854               |
| 484                | 576                | 1-00               |
| 606                | 720                | 7854               |
| 968                | 1152               |                    |
| 847                | 1008               | 676                |
|                    |                    | 845                |
| 950334 area        | 1-130976 area      | 1353               |
| 7854               | 950334             | 1183               |
| 164934 sign fluent | 180642             | 1-327326 area      |
|                    | 164934             | 1-130976           |
|                    | 015708 sign const. | 196350             |
|                    |                    | 180642             |
|                    |                    | 015708 sign const. |
|                    |                    | 015708 sign const. |

|                |     |               |
|----------------|-----|---------------|
| 7854 seq. log. | 1   | 1-767150      |
| 164934 s. f.   |     | 243474        |
| 015708 s. c.   |     | 15708         |
| 950334 area    | 1-1 | 2-010624      |
| 180642 s. f.   |     | 259182        |
| 015708 s. c.   |     | 15708         |
| 1-130976       | 1-2 | 2-269806      |
| 196350 &c.     |     | 274890        |
| 15708          |     | 15708         |
| 1-327326       | 1-3 | 2-544696      |
| 212058         |     | &c.           |
| 15708          |     | ad infinitum. |
| 1-530964       | 1-4 |               |
| 227766         | &c. |               |
| 15708          |     |               |

3.1416=seq. log. whose diameter is 1 for the circumferences of circles.

| 3.1416<br>1.1 diam.     | 3.1416<br>1.2 diam.              |
|-------------------------|----------------------------------|
| 3.45576 circ.<br>3.1416 | 3.76992 circ.<br>3.45576         |
| 3.1416 s. c.            | 3.1416 s. c. {<br>3.1416 s. c. } |

|                  |     |                   |     |
|------------------|-----|-------------------|-----|
| 3.1416 seq. log. | 1   | 4.71240           | 1.5 |
| 3.1416 s. c.     |     | 3.1416            |     |
| 3.45576 circum.  | 1.1 | 5.02656           | 1.3 |
| 3.1416 s. c.     |     | 3.1416            |     |
| 3.76992 &c.      | 1.2 | 5.34072           | 1.7 |
| 3.1416           |     | 3.1416            |     |
| 4.08408          | 1.3 | 5.65488           | 1.8 |
| 3.1416           |     | &c. ad infinitum. |     |
| 4.39834          | 1.4 |                   |     |
| 3.1416           |     |                   |     |

In my next, which, Sir, I will hand you as soon as I conveniently can, I purpose showing the manner in which this method of calculation was adopted to obtain the solidities and superficies of spheres, and the areas and length of diagonals of squares. In the mean time your early attention to the above will much oblige, Sir,

Your obedient Servant,

AN ENGINEER.

## History of the Steam Engine, Chap. IV.

Continued from p. 279.

MURDOCK'S ROTATIVE ENGINE.—CROWTHER'S CRANK MOTION.—CARTWRIGHT'S PORTABLE ENGINE.—MURRAY'S AIR PUMP AND VALVES.

Mr. W. Murdock, of Redruth, in Cornwall, obtained a patent in 1799, for a better method of boring cylinders, and for casting the steam case of Watts's engine in one entire piece, to which the top and bottom of the cylinder are attached. He also proposed to cast the cylinder and steam case of one piece of considerable thickness, and bore a "cylindric interstice" between the case and cylinder, leaving them attached at one end !!! In another part he proposes to simplify the construction of the valves of the condensing engine, by connecting the upper and lower valves so as to work with one spindle or rod; the rod which connects them being tubular answers as an eduction pipe to the upper end of the cylinder.

But the most notable invention here described is a Rotative Engine, which consists of two toothed wheels working into each other, and fitted into a double case resembling two cylinders with a segment cut off each. *a b*, are the two axes upon which the two wheels *D D* are fixed. The teeth are supposed to be packed at the parts in contact

with the exterior cylinder. The teeth which are in contact are so fitted as to prevent any escape in that direction. Steam being introduced at the pipe *s* a rotative motion would be produced; but the construction would be so defective, and the friction so great, as totally to prevent its ever answering in practice. At the same time we ought to correct an erroneous opinion which many have formed respecting this machine, which is, that it would not move at all; it being thought that as the surface of the teeth *e e* are as great as that of *f f*, that there would be as great a tendency to turn one way as another, and therefore no motion would be produced. But it will be seen that as the teeth *e e*, though individually of equal superficies with *f f*, overlap each other, the surface presented to the action of the steam is only equal to one tooth, therefore the effect of the steam (without calculating friction) would be one half of the real force.

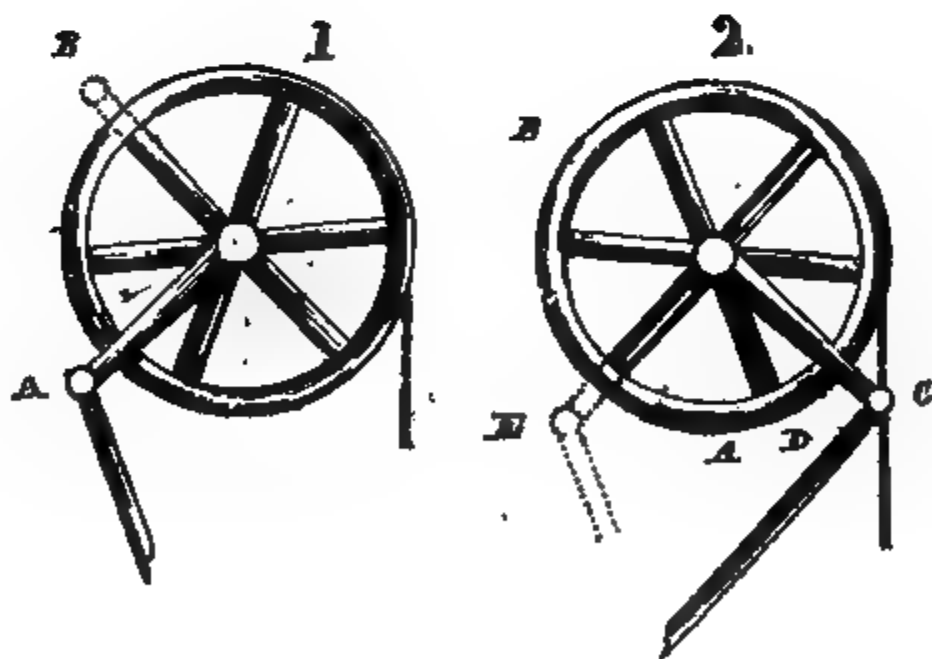
In the year 1800, Mr. Phineas Crowther, of Newcastle upon Tyne, obtained a patent for a method of dispensing with the beam of reciprocating engines by placing the fly wheel immediately above the piston. *a* represents the cylinder; *b b* the parallel motion; and *c* the connecting rod. The principle will be seen by a slight inspection of the drawing without further explanation. Mr. Crowther constructed several good engines on this plan which were found to succeed very well.

The Rev. Edward Cartwright obtained a patent for a Portable Engine in 1801, of which the following is a description.

It consists, first in so disposing the different parts of the Steam-Engine as that the boiler, the cylinder, the fly wheel, and all the moving parts of the engine, shall be embraced by, comprehended within, or attached to a frame erected upon the boiler, and so connected together as to make one whole or perfect machine; so com-

pact as to be easily portable; and requiring no farther trouble and expence, after it is finished at the manufactory, than to place it upon the fire, when it will be immediately ready for the office for which it is intended; for this purpose it will be most convenient to make the boiler oblong, and straight-sided, with a flat top, placing the cylinder within the boiler, a position which has, indeed, been already adopted by others, though for a different purpose. The frame extends lengthways on the sides of the boiler, and may project a little beyond that end of the boiler where is fixed the air-pump and

condenser. To the part of the frame so projecting, the air-pump and condenser may be attached or suspended. Across the frame is an axle, with a pulley upon it, round which goes a chain or strap, to the top of the piston rod. Upon this axle is a crank, from which goes a connecting-rod to a lever, lying horizontally on the top



of, or alongside the boiler. Besides the axis above-mentioned, there is another axis lying across, either immediately above or below, or on one side, of the former one. Upon this axis, which is the axis of the fly-wheel, is a crank, from which goes a connecting rod to the same lever, that was spoken of before.

Now it is evident, that when the pulley is put in motion by the action of the piston, the crank upon its axis will move the crank upon the axis of the fly-wheel, as they are both connected to the same lever. If, therefore, the pulley is made to move in a direction from A to B, (*see Fig. 1.*) and back again, by the action of the piston, and its counterweight; and if the crank upon its axis moves in the same direction likewise, the crank upon the axis of the fly-wheel will also do the same, unless it is made, as it must be, of such a determinate length as that when it reaches the extremity of its motion it can pass forwards; in that case a rotatory motion is produced on the fly-wheel. Again, if the crank upon the axis of the pulley is so disposed as that when the pulley moves from A to B, or through any space not exceeding a complete revolution, (*see Fig. 2.*) the crank shall pass from C to E, through D, or in that direction, according to the space through which any given point of the pulley passes the crank will give two vibrations to the lever for one stroke of the engine, which will give two revolutions of the fly-wheel in the same time. Again, if the diameter of the pulley be so reduced as that the stroke of the engine shall make the pulley revolve once and a half round and back again, the crank will occasion the lever to vibrate three times for every stroke of the engine. Again, if the diameter of the pulley be so reduced as that it shall make two complete revolutions, and back again, for one stroke of the engine, in that case the crank will give four vibrations to the lever for one stroke of the engine, and the fly-wheel will revolve four times. By this invention the fly-wheel may be made to run with any requisite velocity without the intervention of any kind of wheel-work.

Secondly. For the purpose of lessening the waste of power, and regulating the velocity of the engine, instead of making the governor act upon the throttle valve, by causing it to give motion to a wedge, sliding at liberty backwards and forwards, under the weight which keeps the steam valve open. If in any particular case it should be thought convenient to have the fly-wheel below, its axis must be placed underneath the lever, connecting it to the lever by a rod as before.

Thirdly. When a reciprocating motion is required horizontally, the connecting rod of either crank is extended as far below the lever as may be necessary, and at the bottom; that which is wanted to have a reciprocating motion hangs to it in a joint.

The air pump, as well as any other pump that may be wanted, is worked by a lever, which receives action by the piston. And to such lever is applied the necessary counterweight.

If the engine is a double one, there must be a double chain or strap round the pulley, so that the piston may act upon the pulley

both in its descent and ascent. Or the action may be given to the axis of the crank by a rack and pinion.

A, the cylinder.

B, the boiler.

C, pulley put in motion by the piston and its counterweight.

D, the crank upon the axis of the pulley.

E, the connecting rod.

F, the lever.

G, the fly-wheel.

H, the crank upon its axis.

I, rod connecting it to the lever F.\*

This engine is portable and cheap, but we think it falls short of Mr. Cartwright's former scheme for ingenuity; we dislike racks and pinions where they can possibly be avoided; neither do chains deserve, in our opinion, more commendation. Both these plans are inferior, in our judgment, to many engines in actual use at the date of this patent.

Mr. Matthew Murray's patent of 1801, contained more meritorious and useful schemes than his former patent, most of them being generally in use at the present day. We shall describe his valves, commonly called nozzles, nossels, or nozles.

*p*, in the present figure, is the pipe conveying steam from the boiler, and delivering it into the descending pipe *p*, which terminates in the valve *q*, opening to the lower part of the cylinder by the side opening marked as a shaded parallelogram, while the valve *r* opens a similar communication with the upper part of the cylinder, so that by the successive opening and shutting of *q* and *r*, steam is admitted above and below the piston: *s* is the lower end of the eduction pipe, joining on to the condenser, and this pipe opens first to the lower part of the cylinder by the valve *t*, and leads also by a perpendicular continuation of the same pipe *v*, to a valve *u*, by which a connection is formed with the upper part of the cylinder. The two apertures into the cylinder, called nozzles, are therefore common both to the admission of steam, and formation of the vacuum, which is regulated simply by the working of the valves. For as the figure now stands, *r* is the only open valve in the steam pipe, consequently steam would enter above the piston to depress it, while a vacuum would exist below it on account of the valve *t* being open to the condenser. As soon as the piston reaches the bottom of the cylinder, the valves *r* and *t* must be shut, and *u* and *q* opened, when the steam being no longer able to get through *r*, would pass down the pipe *p*, and enter the lower part of the cylinder through *q*; meantime, *u* being open to the condenser by the pipe *v*, would cause the necessary vacuum above the piston to permit its ascent, which being completed, the valves must be again put into the position shown in the figure, to produce its descent, and so on. It will be sufficient to state that these valves are operated upon, either by levers passing in a steam-

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\* Specification of Patent, 1801.

tight manner through the side pipes, or that sometimes the spindles of the valves are made to act one through the other in stuffing, as in the present instance, when they are worked by external applications. It is likewise not unfrequent to connect a steam and condensing valve, when they are required to open and shut simultaneously by an external rod. Motion is communicated to the valves in such engines as are without a fly-wheel, by a rod, or beam, attached to the engine beam, very near to the cylinder end of it, and called a plug tree; this plug-tree is equipped with certain adjustable projections, called tappets, which strike the levers or handles of the valves, and thus open and shut them at the proper intervals as they rise and fall with the beam.\*

By this most ingenious contrivance no waste of steam arises, excepting in the small aperture between the valves; the friction is likewise much less than either slides, cocks, or indeed any other kind of valve—the only resistance to their motion being the pressure upon the upper side by the steam, when in their seats. Their cost, compared to that of the slide-valve, is much greater, but as they are not liable to wear, and work with great accuracy, the extra expense does not prevent their very general adoption for large engines.

*To be continued.*

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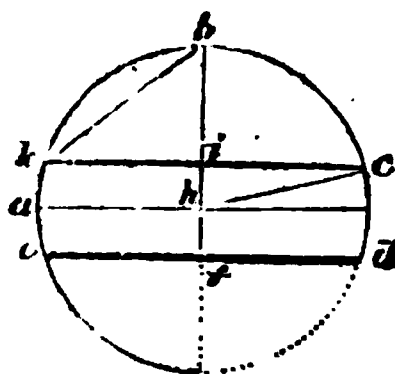
\* Millington's Epitome.

## LETTERS OF INQUIRY.

**WATER WHEELS.**—"A Country Subscriber (no mechanic) would be much obliged by information, through the medium of any of your intelligent correspondents, how to make the most advantageous use of an *eight feet* fall of water, a *constant* and *VERY ABUNDANT* supply, neither incommoded with back water, or liable at any time to be flooded.

"He is advised on the one hand to put up a cast-iron bucket wheel of *eighteen* feet diameter, twelve feet wide;—on the other a wheel of *ten* feet diameter, fourteen feet wide.

"It being intended to drive small machinery with *great velocity*, which of the two ought he to adopt for such purpose, *not to lose any of the power of the stream and fall?*—or, what would be the best dimensions of the wheel, and what the horse power of same?"



**PRACTICAL GEOMETRY.**—"W. W. is desirous of being informed, at what distance from the centre of a circle must two cords be struck parallel to the diameter, to divide the said circle into three equal parts, the diameter of the same being five inches?"

## LIST OF EXPIRED PATENTS, IN OCTOBER, 1826.

**KNIFE AND SCISSOR SHEATHS.**—To F. Deakin, of Aston, Warwickshire, for a method of making knives, scissors, &c.—sheaths or cases.

**CARPET-WEAVING.**—To Thomas Pardoe, of Newgate Street, for a method of making Eldermuster or Scotch carpeting in pieces of different widths, exceeding 34 inches wide, whereby a complete pattern or figure is made to extend the whole width of the piece, &c.

## TO OUR READERS AND CORRESPONDENTS.

We are now devoting a large portion of each number of the REGISTER to Mr. Galloway's History of the Steam Engine, with the view of completing it in the present volume. The inventions about being described being of modern date, and of the highest interest, we trust that our plan is in consonance with the taste of our readers.

W. S.'s communication we fear will be unintelligible without the aid of an illustrative drawing of the apparatus.

M. H.—W. R.—and Mechanicus are received.

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OF

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**HEATHORN'S PATENT COMBINATION OF A LIME  
KILN WITH COKE OVENS.**

## HEATHORN'S PATENT COMBINATION OF A LIME KILN WITH COKE OVENS.

THE object of this invention is to prepare quick-lime and coke in the same kiln by a single operation; and the arrangements to effect it are at once so simple and so complete, as seemingly to preclude the capability of any material improvement. The economy of the process is likewise carried to the greatest possible degree; for that portion of the coal which is separated from it to form coke, is, by its combustion, rendered subservient to the burning of the lime stone; and the coke, owing to its increased bulk, being nearly (if not quite) as valuable as coal in the market, the expense, if any, must be very trifling.

The preceding engraving represents a vertical section of the lime shaft and coke ovens: *aa* are the side walls, four feet thick, of a rectangular tower, the internal space being filled with lime stone, from the top to the iron bars, *bb*, at bottom, whereon the whole column rests. The lime stone is raised in a box *d*, or other proper receptacle, to the top of the building, by means of a jib and crane *e*, or other tackle, which is fixed at the back of the tower, together with a platform, projecting beyond the walls for affording security, and convenience for "landing" the lime stone: when raised as represented, the jib is swung round, and the lime box tilted, by which the whole contents are thrown down the shaft.

The coke ovens, of which there may be two, or a greater or lesser number, according to the magnitude of the works, are constructed and arranged in connection with the lime shaft in the same manner as the two represented in the diagram at *ff*. These ovens are supplied with coal through iron doors in the front wall, (not seen in the section;) the doors have a long and narrow horizontal opening in the upper part of them to admit sufficient atmospheric air to cause the combustion of the bituminous or inflammable part of the coal; the flames proceeding from thence pass into the lime shaft through a series of lateral flues, (two of which are brought into view at *gg*,) and the draft is prevented from deranging the process in the opposite oven, by the interposition of the partition wall, *h*, which directs the course of the heat and flames throughout the whole mass of the lime; the lowermost and principal portion of which attains a white heat, the upper a red heat, and the intervening portions the intermediate gradations of temperature.

When the kiln is completely charged with lime, the openings in front and beneath the iron bars, at *ii*, are closed and barricaded by bricks, and an iron-cased door which is internally filled with sand, to effectually exclude the air, and prevent the loss of heat by radiation. Therefore, when the kiln is at work, no atmospheric air is admitted but through the narrow apertures before-mentioned in the coke oven doors.

When the calcination of the lime is completed, the barricades at *ii* are removed, the iron bars at *bb* are drawn out, by which the lime falls down and is taken out by barrows. It sometimes

happens, however, that the lime does not readily fall, having caked or arched itself over the area which incloses it, in which case a hooked iron rod is employed to bring it down. To facilitate this operation in every part of the shaft, where it may be necessary, a series of five or six apertures, closed by iron doors, are made at convenient distances from the top to near the bottom of the shaft, two of these are brought into view at *h h*, where their utility is made apparent in the diagram. Two similar apertures are shown in section in the coke ovens at *l l*, which are for the convenience of stoking or clearing out the lateral flues, *g g*, from any matter that might obstruct the free passage of the flames and heated air.

When the coals have been reduced to coke, the oven doors in front (not shown) are opened, and the coke taken out by a peel iron, the long handle of which is supported upon a swinging jib, that acts as a moveable fulcrum to the lever or handle of the peel, and thus much facilitates the labour of taking out the contents of the oven:

The other arrangements of the patentee for conducting the business of lime and coke works economically on the large scale, are worthy of the particular notice of persons engaged in that department of our manufactures; but our limits prevent us from going into their detail.\* There are, however, some points of importance, as respects the latter class of persons, which we ought not to omit, and as these are stated in a letter received from the patentee (which brought the subject under our notice, and induced us to examine the enrolled specification) we here subjoin it.

*Maldstone, 4th Dec. 1826.*

SIR,

I beg to introduce to your notice a sketch of a Lime-kiln, wherein the whole of the fuel employed is saved, by its being converted into coke.

From a number of experiments on various Kilns constructed on different plans, and conducted under my own immediate inspection, for upwards of ten years past; this Kiln has been completed, and

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\* Since writing the above we have been informed that the patentee guarantees the perfect operation of his Kilns, to those persons who undertake the working of them. Several have been erected under his licence in various parts of the kingdom: one at Hastings, another at Maldstone, another near Hackney; and they have been found to answer beyond the expectations of the proprietors. We forget the exact quantity of coke and lime, which our informant told us they produced weekly, but this will of course depend upon their dimensions: that the quantity must be very considerable is evident upon an inspection of the diagram, especially, also, when it is considered that the heat is constantly maintained, and the process unremittingly continued as long as it is desired: which is effected by supplying fresh coal to the ovens alternately, and lime-stone at the top of the shaft; the lowermost portion of the lime is the first that is completely burnt, which can be withdrawn at pleasure in the manner before-mentioned. Under some circumstances (in certain localities, we presume, where coke may not be in particular request,) the patentee proposes to burn coal tar in the ovens, which will for that purpose be caused to drip upon the red-hot coke or cinders. We have been also informed, at a gas-manufactory where Mr. Heathorn's lime is used, that it is considered to be of a superior quality to that generally found in the market.

(with the advantage of saving the whole of the fuel,) possesses a facility of drawing the lime, equal to a common tunnel-kiln. The gradual manner, also, which it causes the chalk or stone to be burnt into lime, is such as to leave no refuse whatever; and, consequently, the usual operation of sifting the lime is unnecessary.

This Kiln is now, and has been for some time past, in full operation, and may be inspected at the Lime Works of the patentee, Mr. Charles Heathorn, Maidstone; and further particulars may also be had of Mr. H. Heathorn, 40, Coleman Street, London.

I am, Sir, very respectfully, yours,

CHARLES HEATHORN.

### HANCOCK'S PATENT ELASTIC INDIAN-RUBBER SHEATHING.

THE patentee states (we believe correctly) that this invention forms the most effectual barrier against the destructive ravages of the worm, and is the greatest preservative of the ship's bottom, which has ever been invented. It is formed of fibrous materials, such as hair, wool, &c. saturated with a patent compound of Stockholm tar, pitch, and Indian rubber; thus combining the valuable elastic and durable qualities of the Indian rubber, with the known utility of the other articles, with which it is perfectly homogeneous, and being prepared by the patent process, unites with them in one tough mass of great strength and elasticity. Placed between the ship's bottom and the copper, it forms the best possible surface for laying the copper upon; it protects the bolt-heads from corrosion, diminishes the objections to coppering iron-fastened ships, prevents leakage from butt-ends, defects in caulking, treenail-holes, or from any of those causes which so often (even in new ships) produce leaks which are difficult to stop, as it is difficult to trace their source: it gives important security to old and weak ships, and offers an invaluable safeguard to ships heavily strained, or broken from stress of weather, or from having been ashore, every ship sheathed with it, being, as it were, fothered throughout.

A log of wood has been subjected to the following experiment:—A piece of fir timber was covered with a very thin coating of the composition, then sheathed with inch deal, towed from Liverpool to Demerara, left three months in the water there, and then towed to London. The fir sheathing is pierced in all directions, but the worm has always recoiled from the composition, which is in no instance penetrated by the animal. The timber protected by it remains sound and untouched, forming a striking contrast to the honeycombed state of the external unprotected fir sheathing, although the layer of composition is not thicker than a wafer. A considerable saving will also be effected by the use of this sheathing, as it does not require any coating of pitch or tar, and as the sheets of copper may be nailed on it with a perfectly smooth surface, it may be applied with equal benefit under copper on the single bottom, or under wood sheathing, at a considerably cheaper rate than any felt. The price of the sheathing is 10d. per sheet, of the common size of 34 inches by 20.

Specimens of the sheathing, and the price of timber above mentioned, may be seen at the manufactory, Stratford, Essex; or at N<sup>o</sup>. 19, Austin Friars, London.

### PATERSON'S BLOWING MACHINE.

SIR,

I enclose you a description of a Blowing Machine, the invention of a Mr. Paterson, of Lanark, which I think is deserving of a place in your valuable repository of mechanical inventions. By it two cylinders are employed blowing alternately, by which the blast is equalized without the aid of either water-pressure or an air vessel.

This machine, which has been used by Mr. Paterson for some time back, is driven by a water-wheel of five horses power. That gentleman has found that he can smelt at least one-third more iron with the same quantity of coke, and make larger pigs; the iron is, likewise, more completely fused than when the blast of only one cylinder was employed. The strain upon the crank is uniform, and, consequently the jolting, so injurious to machinery, is obviated.

*a* is the vertical cylinder; *b* the horizontal cylinder; *c c* two connecting rods united to the crank *d*; *e* the walking beam; *f* the parallel motion; *g* the pipe for conveying the blast to the cupola or furnace *h*; *i* a small wheel, running in a groove upon a cast-iron plate; *j* two cast-iron plates supporting the vertical cylinder, between which the lowermost connecting rod *c* passes. At *k k* valves are placed to admit the air into the vertical cylinder: similar valves are placed at the ends of the horizontal cylinder, to admit the air into it. The operation of the machine is too evident from an inspection of the drawing to need further description.

Leeds, 29th Nov. 1826.

Your constant Reader,  
C. WALTHIW.

### LONDON MECHANICS' INSTITUTION.

On Tuesday, the 12th December, a meeting of the Members of this Institution was held for the purpose of awarding two prizes of £10 each, pursuant to the terms of a gift by Dr. Fellows; one for an essay, the other for a mechanical invention. The president an-

nounced that the prize for writing the best essay on one of the mechanical powers, had been adjudged to Thomas Holmes, a journeyman shoemaker. At the age of sixteen Mr. Holmes happened to read Pinkerton's Geography, and finding himself unable to comprehend the introduction, which treated of astronomy, from his ignorance of arithmetic and mathematics, he commenced the study of those sciences. At the formation of the Institution he became a member of it, and attended the Lectures regularly; the result of his assiduity was an essay, which the learned president characterized as being similar to the writings of Maclaurin, the celebrated commentator on Newton, and as containing one of the best explanations of the properties of the bent lever he had ever seen.

The prize for the invention of the most complete and useful machine, the president said had been adjudged to George Henry Lyne, who had invented an admirable piece of mechanism, principally for cutting combs, but which may be applied to numerous other purposes. The machine was exhibited and worked, and its properties explained at length, by Professor Millington. [*A description of this beautiful invention, by which two combs are accurately and speedily cut out of a piece of tortoiseshell, or other substance, without any waste of the material, is given in our 87th number, with engraved delineations.*]—Mr. Lyne was lately a journeyman smith, but now manufactures these and other machines, as an engineer, and is fast rising to a higher rank in society.

The Duke of Sussex delivered the prizes to the successful candidates, with many expressions of encouragement and commendation. The theatre of the Institution was crowded in the extreme, notwithstanding which the nicest order was observed, as is, indeed, uniformly maintained in this interesting assembly.

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### WILLIAMS'S PATENT APPARATUS FOR DISTILLATION.

THE improvements projected under this patent are comprised under the following heads; viz. an enlarged capacity of the still-head, to cause a separation of the aqueous vapour by condensation, previous to its passing over the neck of the still, into the spirit condenser; in the employment of numerous small vertical tubes surrounded with cold water, to increase and accelerate the condensation; in the adaptation of a peculiarly constructed "cooling worm," by which it is conceived, the quantity of spirit will be increased, by preventing evaporation in its progress to, and when in the receiver; and in the employment of refrigerating saline mixtures for the more effectual cooling of the spirit in warm climates or in warm weather.

This invention has been patented about six years, which circumstance gives it greater claims upon our admiration, than if it were the invention of this precise period of time, so fraught with great improvements in the art of distillation; many of which, however,

appear to us to have been indebted in a great degree, to this fine example.

In the body of the still, (that part where the vapour is generated) there is no improvement proposed, but an enlarged capacity of its globular head, to cause the watery particles to fall back into the still; this part of the apparatus we have omitted in our diagram, as it requires no additional explanation; the engraving, therefore, relates wholly to the apparatus for condensation.

*a* is the termination of the neck of the still which conveys the vapour into the "upper drum" *b*, whence it is divided among a number of small vertical tubes *c*, which the patentee says, should not exceed  $\frac{1}{4}$  of an inch in their interior diameter. As the tub inclosing this apparatus is filled with cold water, the condensation immediately commences in the upper drum, and is completed in its subsequent progress through the vertical tubes, and the "lower drum" *d*. From thence the fluid runs down a central neck *e*, into the trap *f*, from the upper part of which trap it enters the cooling worm *g*. It is evident that the trap *f* is in working, always partly filled with liquid, and the neck *e* being immersed therein, any vapour which may have escaped condensation can pass no further. The trap *f* has a funnel-shaped bottom, from which a pipe *h* passes through the coils of the worm, and through the side of the tub, where it is furnished with a cock, for the purpose of drawing off any impure spirit which may be separated from the wash in the first stage of the process; and to discharge what may remain in the trap when the process is over. To the trap *f* is also attached another pipe *i*, called

the safety pipe, for the purpose of allowing "the egress and ingress of atmospheric air from and to the condenser, to prevent both pressure and a vacuum therein." The coils of the cooling worm are made octangular; the worm itself is made flat, and of considerable breadth; a transverse section of it is exhibited in the separate figure *k*, which shews it to be in the form of a parallelogram, whose longest sides are four inches, and its shortest half an inch wide. This octangular worm after making six complete turns, assumes a circular shape and diverges off to pass through the side of the tub; at its end outside the tub, which is made a little tapering, is fitted, and is to be occasionally applied, a crane necked pipe *l*, which pipe may be elevated or depressed at pleasure, for the purpose of keeping three or more of the coils of the worm full of liquid. This crane necked pipe is intended to be applied in hot weather, or hot climates, to cool the spirits more effectually, and prevent their evaporation by subjecting the same in a greater degree to the effect of the cold water in the worm tub.

An additional apparatus to be used in hot climates of undoubted utility is likewise recommended by the patentee, and claimed by him as his invention. It consists of another pipe *m*, into which the discharging end of the crane-necked pipe is made to enter, and which pipe after passing the end of the trough *n* is made of a very broad flat shape, and running the whole length of the trough (which may be of any extent;) it is then to return by a very slight descent, so as to run back very gently into the funnel of the pipe which conveys it into the receiver.

The trough *n* is to be filled with Glauber's salts and nitre, or any saline mixture capable of producing intense cold, for the more effectual cooling of the spirit; the trough may be placed upon wheels and axles for the convenience of bringing it to, and conveying it from its required situation.

The patentee further recommends, but does *not* claim it as a patent right, that the ash-pit of this still, as well as of stills generally, be furnished with a plate iron door, in which is to be introduced near its top one or more registers as shewn in the separate figure at *o*, the apertures in which are to be sufficiently large *when open to admit the necessary volume of air to feed the fire*, but which may be closed more or less to produce the required draught, and thereby enable the distiller to check or increase the ebullition at pleasure and with the greatest facility.

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## History of the Steam Engine, Chap. IV.

*Continued from p. 287.*

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### MURRAY'S AIR PUMP.—NUNCARROW'S ENGINE.

At the same time Mr. Murray described a new air-pump, in which the air in the condenser was discharged from the air-pump without an effort to open the valves, or press through a body of water, and

in which the air and water were discharged, separately, in different ways; this he effected by discharging the air alone by one bucket, and the water alone by another, or by an eduction pipe of 28 feet in length. A represents the condenser; B the air-pump; C the air piston; D the air valve which is opened and shut by the working parts of the engine, and has an elastic rod; E the valve for discharging the air; F the exhausting pipe, having a free communication betwixt the condenser and the top of the air pump, when the valve D is open; G the eduction pipe; K a bucket for lifting the water upwards as in a common pump; L a foot valve for preventing

a return of the water during the descent of the bucket K ; M the barrel of the pump for discharging water alone. This, together with an inspection of the preceding diagram, will serve to shew the nature of his invention. The utility of the separate discharge of the air and water is unquestionable ; but whether this will compensate for the increased expense and complexity can only be ascertained in practice. Mr. Murray's scheme, however, has been again made the subject of a patent, a short time ago, by Mr. George Stephenson, of Newcastle.

In the same year (1801) Mr. Bramah obtained a patent for an improvement in the fourway cock, by causing it to make a continuous revolution instead of a partial one (as used previously). By this method the wear was more regular, which rendered the cock durable, and it was likewise more certain and correct in its action.

Mr. John Nuncarrow's engine, for giving motion to a water-wheel, by a fall obtained by the power of steam, acts upon the same principle as those of Papin and Savery, but as his machine possesses many great advantages over theirs, we shall offer no apology for its insertion.

A is the receiver, which may be made either of wood or iron. B B B B B are wooden or cast iron pipes, for conveying the water to the receiver, and thence to the penstock. C the penstock or cistern ; D the water wheel ; E the boiler, which may be either iron or copper ; F is the hot well for supplying the boiler with water ; G G are two cisterns under the level of the water, in which the small bores B B and the condenser are contained. H H H is the surface of the water with which the steam engine and water wheel are supplied ; *a a* is the steam pipe through which the steam is conveyed from the boiler to the receiver ; *b* the feeding pipe, for supplying the boiler with hot water ; *c c c c c* the condensing apparatus ; *d d* the pipe which conveys the hot water from the condenser to the hot well ; *e e e* valves for admitting and excluding the water ; *f f* the injection pipe, and *g* the injection cock ; *h* the condenser.

It does not appear necessary to say any thing here of the manner in which this machine performs its operations without manual assistance, as the method of opening the cocks, by which the steam is admitted into the receiver and condensed, has been already well described by several writers. But it will be necessary to remark, that the receiver, penstock, and all the pipes, must be previously filled before any water can be delivered on the wheel ; and when the steam in the boiler has acquired a sufficient strength, the valve as at *c* is open, and the steam immediately rushes from the boiler at E into the receiver A, the water descends through the tubes A and B, and ascends through the valve *e*, and the other pipe or tube B into the penstock C. This part of the operation being performed, and the valve *c* shut, that at *a* is suddenly opened, through which the steam rushes down the condensing pipe *e*, and in its passage meets with a jet of cold water from the injection cock *g*, by which it is condensed ; a vacuum being made by this means in the receiver, the water is driven up to fill it a second time through the valves *e e*, by the pressure of the external air, when the steam valve at *c* is again opened, and the operation repeated for any length of time the machine is required to work.



There are many advantages which a steam engine on this construction possesses, beyond anything of the kind hitherto invented; a few of which the inventor thus enumerates:—

1st. It is subject to little or no friction.

2ndly. It may be erected at a small expense, when compared with any other sort of steam engine.

3rdly. It has every advantage which may be attributed to Boulton and Watt's engines, by condensing out of the receiver, either in the penstock or at the level of the water.

4thly. Another very great advantage is, that the water in the upper part of the pipe adjoining the receiver acquires a heat by its being in frequent contact with the steam, very nearly equal to that of boiling water: hence the receiver is always kept uniformly hot, as in the case of Boulton and Watt's engines.

5thly. A very small stream of water is sufficient to supply this engine (even where there is no fall); for all the water raised by it is returned into the reservoir H H H. From the foregoing reasons it would seem that no kind of steam-engine is better adapted to give rotary motion to machinery of every kind than this. Its form is simple, and the materials of which it is composed are cheap; the power is more than equal to any other machine of the kind, because there is no deduction to be made for friction, except on account of turning the cocks, which is but trifling.

But it should be observed on the other hand, that one of the properties of this machine, enumerated by the inventor as an advantage, would be found more a defect than otherwise; we allude to the water in the upper part of the pipe being heated by the steam. For though less steam would be lost by condensation, yet it should be remembered that it is impossible to form a vacuum on the surface of boiling water. The only way, therefore, that the water would be raised up the column B, would be by the condensation in C being more rapid than the steam could be generated from the boiling water in B. But we apprehend steam would be generated thus almost as quick as it could be condensed, and therefore the operation of filling B would prove very slow. The addition of a non-conducting float might probably, in part, obviate this objection.

## CHAPTER V.

CONTENTS.—ORIGIN OF THE STEAM BOAT.—EVAN'S ENGINE AND EXPERIMENTS. ROBERTSON'S ENGINE.—TREVITHICK AND VIVIAN.—MURRAY'S PORTABLE ENGINE.—WOOLF'S BOILER, &c.—HORNBLLOWER'S STEAM WHEEL.—BOAZ' IMPROVEMENTS ON SAVERY.—TROTTER'S ROTATIVE ENGINE.—FLINT'S ENGINE.—WILCOX'S ROTATORY ENGINE.—MAUDSLAY'S PORTABLE ENGINE.

Our history is now brought down to the time in which the minds of ingenious mechanics were actively engaged in the project of applying the steam engine to propelling vessels. The idea had, as we have shown, been entertained both by Savery and Halls, the latter of whom obtained a patent for the application of the crank to Newcomen's engine, with the expectation of carrying his plan into effect

by this means. But the steam engine was at that date too imperfect to admit of success; and we cannot, therefore, attach greater importance to the schemes of these individuals, than we should to the projects of numberless other men to whom the idea had, no doubt, frequently occurred long before the steam boat was brought into successful operation. Who the person was that made the first attempt to carry into effect this most important improvement, has, like most such meritorious inventions, become the subject of dispute. It appears that the earliest experiments tried in England were in 1801: but if we may credit the statements of a most ingenious mechanic, (Mr. John Evans, of America,) it appears he had published a description of a method of driving boats by steam, in 1785. Untoward circumstances prevented Mr. Evans from carrying his plan into effect until 1804; but he does, in our opinion, fully establish his claim to the first contrivance of a *practicable* steam boat. We shall insert Mr. Evans's own account of the commencement and progress of his ideas and experiments, as we consider them sufficiently important to merit every publicity.—

[For this detail we must refer our readers to Mr. Galloway's History, p. 93 to 99, which our limits in this Work do not admit the insertion of; we shall, therefore, pass on to Mr. Evans's descriptive account of his valuable Steam Engine.]

“ It appears necessary to give the reader some idea of the principles of the steam engine which is to produce such new and singular effects; and this I will endeavour to do in as few words as I can, by showing the extent to which the principles are already applied.

“ To make steam as irresistible or powerful as gunpowder, we have only to confine it, and to increase the heat by adding fuel to the boiler. A steam engine, with a working cylinder, only nine inches in diameter, and the stroke of the piston three feet, will exert a power sufficient to lift from 3000 to 10,000 lbs. perpendicularly, two and a half miles per hour. This power, applied to propel a carriage on level roads or railways, would drive a very great weight with much velocity, before the friction upon the axletrees, or the resistance of the atmosphere, would balance it.

“ This is not speculative theory. The principles are now in practice, driving a saw-mill, at Manchacks, on the Mississippi; two at Natchez, one of which is capable of sawing 5000 feet of boards in twelve hours; a mill at Pittsburgh, able to grind twenty bushels of grain per hour; one at Marietta, of equal power; one at Lexington, (Kentucky,) of the same power; one a paper-mill, of the same power; one of one-fourth the power, at Pittsburgh; one at the same place of three and a half times the power, for a forge, and for rolling and slitting iron; one of the power of 24 horses, at Middletown, (Connecticut,) driving machinery of a cloth manufactory; two at Philadelphia, of the power of five or six horses; and many making for different purposes; the principles applying to all cases where power is wanted to drive machinery.”

Mr. Evans at the same time describes his own steam engine, which is well known to be in very general use in America.

1-1-1

A the boiler, B the working cylinder, C the lever beam, D the fly wheel, E the cistern or condenser, F the cold water pump, G the supply pump, H the fire place, I the chimney flue, K the safety valve, which may be loaded with from 100 to 150 lbs. to the inch area; it will never need more, and it must never be fastened down.

The boiler being filled with pure water (rain or distilled water) as high as the dotted line, and the fire applied, the smoke enters the centre flue, which passes through the centre of the water to ascend the flue I, and thus acts on a large surface.

When the steam lifts the safety valve, it is let into the cylinder by opening the throttle valve, and drives the piston up and down, which, by the rod 1, gives motion to the fly wheel; and the wheel 2 gives motion to a shaft, passing through the supports of the cylinder to turn the spindle of the rotary-valves, 3, 8, which lets the steam both into and out of the cylinder, at the proper time.

The steam, escaping by the pipe 4, curved backwards and forwards in a zigzag form, and immersed in the water in the cistern E, (which is supplied by the cold water pump F,) is condensed; and the distilled water formed thereby descends, by the pipe 5, into the supply pump G, and is forced into the boiler again by the pipe 6.

But as boiling disengages air from the water, so the shifting-valve, 7, is necessary. This valve lifts at every puff of the steam, and a small quantity escapes; and it shuts, and a vacuum is instantly formed, as the crank passes the dead points.

The small waste of water may be replaced by condensing water in the cistern E, and causing it to run down the pipe G, through a hole in the key of a stop-cock one-32nd part of an inch in diameter; a small hole, indeed, to supply a boiler of a steam engine of twenty horses power.

*To be continued.*

## Discoveries & Processes in the Useful Arts.

**ADHESION OF GLUE.**—Mr. Bevan has found that when two cylinders of dry ash,  $1\frac{1}{2}$  inches in diameter, were glued together, and after twenty-four hours torn asunder, that 1260 lbs. were required for the purpose, and consequently that 715 lbs. were required to overcome the adhesion of one square inch of the glued surfaces. The glue was freshly made, and the season very dry. Much smaller powers were obtained with glue which had been frequently melted, the results being then from 350 to 560 lbs: Upon examining the separated surfaces of the first experiment, the glue appeared to be very thin, and did not entirely cover the wood, hence the estimation must be beneath the truth. From a subsequent experiment on solid glue, Mr. Bevan finds that the cohesion equals 4000 lbs. to the square inch, from which he infers, that the application of this substance as a cement is susceptible of improvement.

The lateral cohesion of dry and seasoned Scotch fir, cut down in 1825, was 562 lbs. per square inch, and that of Memel fir, across the grain, from 540 to 840 lbs. *Phil. Mag.*

**THE PLEXIMETER.**—An instrument, under this name, has been invented by a French surgeon, for the purpose of ascertaining (which it is said to do with great accuracy) the existence of any plethoric or other effusion in the chest or abdomen. It consists of a plate of ivory, like the lid of a snuff-box, which is to be fixed on the part to be examined in such a way as to render the sound produced upon it by percussion very distinct. The presence of so small a quantity as two glasses of liquid has been ascertained by the Pleximeter. It likewise enables the operator to discover if the liver or the spleen is enlarged, or if the peritoneum contains any air.

**NEW OIL LAMP.**—Mr. Davies, a lecturer at Manchester, has exhibited a lamp, in which the wick was superseded by a capillary glass tube. The tub was placed in a small wooden basin, which floated upon the oil contained in a glass vessel. A Manchester paper says,—"The flame which was less than an ordinary candle, was uncommonly clear. This lamp consumes very little oil, and appears to be well adapted to the purposes of persons who keep a light in their chamber during the night."

#### LIST OF NEW PATENTS, NOVEMBER, 1826.

**FIRE-ARMS.**—To Benjamin Newmark, of Cheltenham, for improvements in fire-arms. Sealed 7th November. Six months.

**MEDALS.**—To Edward Thomason, of Birmingham, for improvements in the construction of medals, tokens, and coins. 9th November. Six months.

**CARRIAGES.**—To Henry C. Lacy, of Manchester, for a new invented apparatus, on which to suspend carriage bodies. 18th November. Six months.

**NAVIGATION.**—To B. Woodcroft, of Manchester, for improvements in wheels and paddles for propelling boats, &c. 18th November. Six months.

#### TO OUR READERS AND CORRESPONDENTS.

J. R. had better consult Dr. Ure's Chemical Dictionary, where he will meet with all the information he seeks.

The series of papers proposed by C. W. we shall be happy to avail ourselves of at the commencement of our *fifth* volume, the large extracts we are now making from Mr. Galloway's History of the Steam Engine with a view to its early completion, preventing their insertion in the *present* volume.

The letter from Abergavenny has been received.

Mr. Wood's favour has been received; we shall avail ourselves of the first opportunity to attend to his request.

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# REGISTER

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**WASS'S PATENT IMPROVED FURNACE,**  
**FOR RENDERING THE SMELTING OF LEAD ORES AND OTHER MINERAL**  
**SUBSTANCES INNOXIOUS TO THE SURROUNDING NEIGHBOURHOOD.**

### WASS'S PATENT IMPROVED FURNACE.

IN our Third Volume, page 104, we have described a very simple and effectual mode, invented by Mr. Jeffrey, of Bristol, for condensing the deleterious vapours arising from the smelting of metals; in which contrivance it is, however, necessary to have a constant stream or shower of water from the top of the chimney shaft. But as a sufficient current of water can only be obtained in comparatively few situations, the improved arrangements of the patentee (Mr. Joseph Wass, of Ashover, Derbyshire,) become especially deserving the attention of persons engaged in smelting works generally: for in addition to the advantage of obviating the injurious effects upon vegetable and animal life within the range of the metallic vapours, there results, from the adoption of this improved construction of furnace, a considerable profit; which arises from the product obtained by the condensation of those volatile and deleterious particles that are usually allowed to mix with the atmosphere. In the specification before us the patentee says, and we believe with perfect truth, that

—"By the employment of this improved apparatus, smelting and calcining furnaces are divested of their pernicious effects, and such works may in future be erected in any convenient situation, either near to dwelling houses, or by the side of public roads, or on the banks of navigable rivers or canals; and thus, in many cases, produce a very great economy in the expense of carriage. The saving effected by this apparatus in preserving a quantity of valuable matter, which would otherwise, as heretofore, escape, to the injury of the neighbourhood, would of itself amount in one year, where four furnaces are employed (as described in the plan) to a sum equal to the entire cost of the improved apparatus; that is, the upper part of the tower, with its roof, cap, vane, shutter, and appendages,"—which we shall next proceed to describe.

Fig. 1, in the preceding engraving, represents a vertical section of a lofty and capacious tower, placed in the centre of four smelting furnaces, and receiving, by distinct flues, the smoke and vapour from each of them. The drawing being a *central* section, but two of the furnaces are brought into view, which are marked *a a*, their flues *b b*, opening into separate chimneys *c c*, in the tower, which they ascend for twenty or more feet, then by lateral passages, at *d d d*, they respectively enter the central shaft *e e*: here the vapours come in contact with a powerful ascending current of cold air, and are likewise checked in their upward progress, by striking against a dome or cap of iron *f*, which is suspended over the throat of the central shaft *e*. The ascending vapours, thus intercepted and acted upon, are for the most part immediately condensed, and the metallic particles are precipitated upon a floor *g*, called the *ledge floor*. A plan of this floor, and the cap *f*, are given in a separate figure (2), which is a transverse horizontal section of the tower, just above the cap; another advantage resulting from this arrangement consists in the effect produced in the furnaces below, where it is found that the carbonaceous matter is more completely consumed than by the former

disposition of things. Such portion of the heavy particles that do not fall upon the lodge floor are precipitated to the bottom of the central shaft. The cap *f* is suspended by a vertical rod *h*, which is connected to a transverse beam, by means of a sort of stirrup-iron *i*, through which the upper extremity of the rod is screwed, and by the turning of a nut upon this screw, the height of the cap above the throat of the central shaft is regulated. The cap is steadied in its movements and preserved in its position, by several upright bars passing through it, two of which are brought into view; these are perforated with holes, through which keys or bolts are put to lock the cap securely in its place. The lower part of the cap or dome is circumscribed by a broad hoop; by the action of regulating screws, this hoop is shifted up or down over the periphery of the cap, and the passage for the vapours is thus more readily adjusted at pleasure.

The more volatile portion of the vapours pass from under the dome, and ascend to the top of the tower, which being covered with a roof nearly flat, the heaviest particles are driven back, and fall condensed also upon the lodge floor, while the lightest and least pernicious escape into the atmosphere at the lateral openings *k k*. There are a regular series of vent holes all round this part of the tower, one half of which, those that happen to be to windward, are always closed by a circular shutter *m*. The lower extremity of the shaft, upon which the vane *l* is fixed, turns in a bearing upon the cross beam; and the arms of the circular shutter being also attached to this shaft, when the wind turns the vane, the shutter is, consequently, in like manner turned against it. Fig. 3 is a transverse section of the tower immediately under the roof, by which the circular frame of the shutter is shown, as closing one half of the apertures, or those to windward of it.

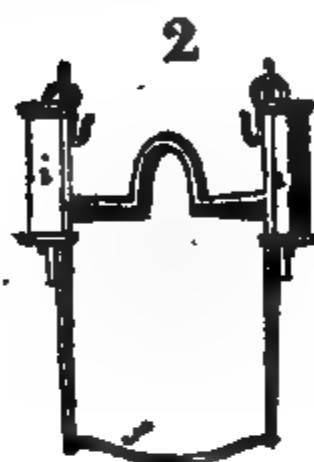
When the deposition from the condensed vapour has become considerable, it is removed from the lodge floor, at a time when the smelting furnaces are not at work. This is done by a man ascending a narrow circular staircase, constructed in the masonry of the tower, up to the lodge floor, where he throws down the accumulated deposition with a shovel to the bottom of the shaft; from thence it is barrowed out, and carried to a roasting furnace.

When any one of the furnaces is not at work, communication with the tower is to be cut off by means of a damper, as those shown at *o o*.

In the drawings attached to the specification a general plan of a smelting work is delineated. The area is inclosed by a quadrangular wall, with a smelting furnace on each side, the chimneys of which are conducted into the central tower. The corners of the quadrangle are occupied by the other buildings required in such establishments. The spaces between the angles of the several flues, the patentee states, may be conveniently occupied by small furnaces for tests and experimental purposes. Another improvement of the patentee deserves mentioning; he directs that the tapping sides of the contiguous furnaces be made 'opposite' to each other; by which is meant that they may both face the area which lies between them, in

order that the fluid metal from the pans of each furnace may be run into pigs, or conveyed into one receiver, and thence into a mould, so as to be formed into thick sheets, ready for milling or rolling: by which arrangement of the furnaces it is considered an important saving of labour and expense will be effected, and the waste by remelting the lead avoided.

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### DIGGLES'S PATENT BRIDLE BIT.

THE ordinary mode of driving from the curb is often attended with serious inconveniences; the continual action of the lever occasions irritation, and the friction of the curb not unfrequently lacerates the mouth of the horse, and so much distresses him as to cause a rejection of his food, and sometimes even to injure the jaw bone. When a horse's mouth has become callous by the constant use of the curb, an *immediate* check upon the steps of the animal, frequently indispensable to the prevention of an accident, is rendered impracticable. Another inconvenience arises from the mouth of the horse being kept partially open, by which he becomes parched, is annoyed by dust, and consequently suffers both in health and spirits.

To obviate these inconveniences, the patentee (Mr. George Diggles, of College Street, Westminster,) has introduced an improvement, which is designed to operate in the same way as a common bit with a curb chain, for ordinary riding or driving, but also affords a means of instantaneously checking the horse, by increasing considerably the "purchase" or leverage of the bit, as the occasion may require, without dismounting from the carriage or horse. This is effected by means of a sliding piece with a ring attached to each cheek of the bit, to which ring the riding or driving rein is to be connected in the usual way; and when it is found necessary to exert a considerable force in curbing the horse, the pulling of the rein will draw the slider towards the bottom of the cheek, thus lengthening the lever so considerably, that the horse is arrested by an irresistible power.

The annexed figure (1) represents a side view of the improved bit, applied to a horse's head in the ordinary riding or driving position; the dotted lines showing the position of the parts when the rein is pulled with considerable force. Fig. 2 gives a front view of the improved bit.

$a$  is the driving or riding rein, attached to the ring  $b$ , which, instead of being fixed to some particular part of the cheek of the bit, is in this improved bit attached to a sliding piece  $c$ . A convoluted spring  $d$  acts upon this sliding piece, and keeps it and the ring  $b$  up to that part of the cheek which is near the mouth-piece, Fig. 2, where the purchase of the lever being small, the driving or riding rein will act in the ordinary manner; but when it becomes necessary to exert an extraordinary power upon the horse's mouth, the rein  $a$  is forcibly pulled back, by which the cheek of the bit is moved out of its perpendicular position, and the sliding piece  $c$  with the ring slides downward towards the lower part of the cheek, as shown by the dotted lines. To prevent the ring and slider from being drawn too low, a stop is placed at  $e$ , on the bit used for a saddle horse, but the bar at the bottom of a driving bit, as seen at  $f$ , Fig. 2, answers this purpose. When the tension upon the rein is relaxed, the elastic force of the spring draws up the sliding piece  $c$  with the ring  $b$ , and the rein  $a$ , to its ordinary place, as represented in Fig. 1.

The cases  $ii$ , which contain the springs are made to slide up and down in grooves, formed in opposite edges of the cheeks, for the convenience of oiling, exchanging, cleaning, or repairing the springs.

## GUPPY'S PATENT SUBSTITUTES FOR MASTS.

THESE are termed in the specification, "improvements in masting vessels"; we have taken leave to call them *substitutes for masts*, and it is with pleasure we add that we think the substitutes very superior contrivances to the latter, as respects convenience and general utility. Instead of a single pole fixed into the keel of the vessel in nearly a vertical position, constituting what is called a mast, the patentee employs two poles or spars, the lower end or heel of each of which is fixed on to the opposite extremities of the beam of a vessel, and likewise to the sides; the poles are then so inclined to one another, as to be connected at their upper extremities, and thus to form with the line of the deck an isosceles triangle: this is the outline of the construction as applied to sloops, or ordinary fore and aft rigged vessels. For square rigged or larger vessels, the poles are not joined at their upper extremities, but at several feet below it, where they cross one another, presenting the figure of a pair of shears. In all cases, however, the lower ends of the poles are fastened in the situation and in the manner before-mentioned. Thus situated, they are invested with the important property or capability of being lowered forward or aft, as occasion may render desirable; by the introduction of hinge joints at their extremities close to the deck. At the junction of the poles above suitable arrangements are

## II



made for setting top-masts thereon, which are provided with gear for that purpose, as well as for the masting of other vessels, for loading or unloading a vessel, and for other purposes to which *alcere* are usually employed on board of ships.

The principal rigging for these "double pole masts" will be the fore and aft stays, the ordinary side shrouds being comparatively unimportant, except for the purpose of going aloft.

At Fig. 1, *a a*, are the two poles, having joints at *b b*, from whence proceeds a strong iron band which clasps the opposite ends of the beam *c*, which underneath diverges into two iron straps that are bolted to the sides of the vessel. This will be clearly understood by an examination of Fig. 4, which gives a perspective side view of the iron work which connects the poles to the vessel, with a portion of the beam, and a pole; *c c* is the beam, with the iron band bolted to it, and showing the straps *d d* that are secured to the sides of the vessel, and are turned for that purpose flat ways towards them. The poles are connected together at *e* by a stout iron band, by scarfing and crossing each other, as shown by the separate Fig. 2 in perspective: *f* is the top, where the upper ends of the poles are strongly secured to one another by straps and bolts: *g* is the lower end of the topmast which passes through a hole adapted to it in the top, with its heel resting upon an iron projection, which is of one piece with the band *e*.

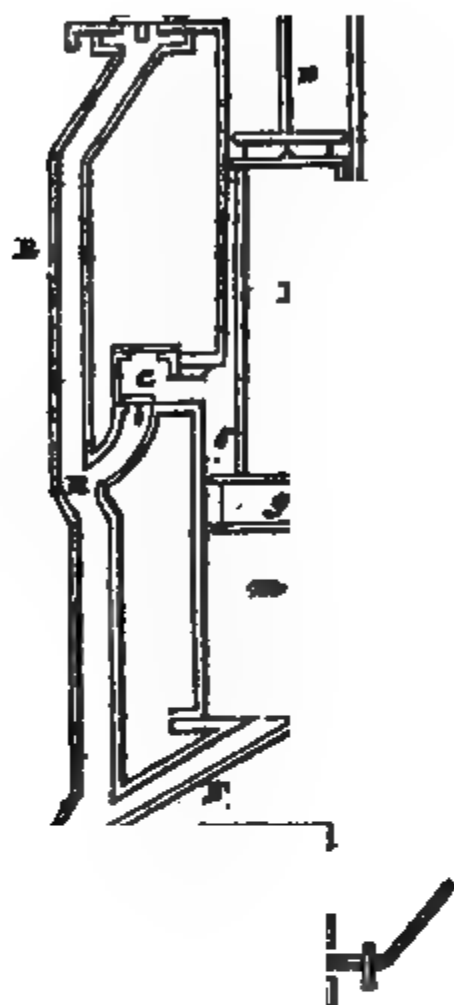
For sloops, and fore and aft rigged vessels generally, the poles *a a* terminate at their junction, and are united by scarfing previous to putting on the strong iron band. The mode of scarfing the patentee leaves to the genius of the mast-maker, but at the same time points out *one* mode which he most approves of, and which, perhaps, cannot be excelled: this mode is shown by the perspective Fig. 3. Connected to the band which unites the poles together are fixed long iron links, *i i*, for hooking on, or "*seizing*" the shrouds to.

We could have wished that our limits had afforded greater space for a more detailed description of this invention, but those of our readers who may desire further information may consult the Repository of Patent Inventions, for November last, (where the specification, together with all the drawings, are correctly given,) or the patentee, Thomas R. Guppy, Esq. of Bristol.

## History of the Steam Engine, Chap. V.

*Continued from p. 303.*

In 1801 Messrs. John and James Robertson, of Glasgow, obtained a patent for an improved steam-engine, the form of which differs little in construction from many other engines, except that in place of one working cylinder in these there are two; in this the lesser (*n*) being placed on the top of the larger (*m*) and made fast to it. To each cylinder there is a piston fitted, which are connected together by a cylinder *D*; or this cylinder is so made as to have the pistons in one piece with it. This cylinder is made so that it may nearly fill the small cylinder *n*; that is, that it may work up and down so that the external surface of the one may not rub on the internal surface of the other. The steam and conducting pipes, with the valves, are explained in the following description of the operation of the engine.—



“ Let the working handles, with the valves, be placed in such a manner, that steam from the boiler may have free access through the pipes and cylinders into the condensing vessel, to free the whole of the air, as in the usual manner. When this is done the engine is set to work by the valves *b* and *c* being shut, and by that of *a* left open, and water let into the condensing vessel *C*, when a vacuum takes place in it by means of the condensation of the steam, and also in the under part of the large cylinder *m*, below its piston (there being a communication from it to the condensing vessel by the pipe *F*) ; at the same time the steam from the boiler has free access through the pipe *A*, and valve *a* into the small cylinder *a*, above its piston *A*, and exerts its force upon it, and presses it downwards with as much force as in the usual manner. But as it is found, from experience, that a considerable quantity escapes past the piston : this piston is in part

detained by the secondary piston *g*, and exerts its force on that part or annular section *s s* that is contained betwixt the cylinders *m* and *D*, and assists in forcing the whole downwards ; while, at the same time, the steam which is lodged in this annular space *s s*, and around the cylinder *D*, prevents so great a quantity from escaping past the first piston, as would otherwise be the case where there is no secondary piston, and the vacuum is much more complete below the first piston, consequently there is a greater power produced from a smaller quantity of steam than with a single piston. During the time of the piston's descent the steam valve *a* is shut, and the elasticity of the steam within the cylinders carries the pistons forward to near the bottom of these cylinders, when the valves *b* and *c* are opened by the handles and plug-work admitting the steam to pass from the upper sides of both pistons through the pipes *B* and *E* to the condensing vessel *C*, while the counter-weight at the other end of the beam, or this connected with a fly-wheel raises the pistons again, when the valves *b* and *c* are shut, and that of *a* opened by the plug-work, when the engine makes another stroke as before. The piston rod *R* joins the working-beam in any of the usual modes, and in other respects the engine is much the same as in common practice."

The same specification describes a most ingenious method of constructing the furnace, by which the smoke was partially consumed, instead of being discharged as hitherto through the chimney. Messrs. Robertson have the credit of being the first who succeeded in this project. After the adoption of this plan several manufacturers had their works indicted as nuisances for not using the improvement, and the smoke incommoded many neighbourhoods so much, that some manufactories were obliged to be stopped on account of it. The invention, in principle, consists in supplying the burning fuel more fully with air, having this fuel more in a body together, and a less quantity in combustion, at the same time, than what usually takes place in other furnaces; which are applied to the same uses ; in supplying the fuel with a portion of fresh air, admitted from an opening made for that purpose, and directed in such a manner as it may come in contact with the smoke, from the kindling coal and great heat of the furnace together, and the fuel being more fully supplied with air, and consequently a greater degree of heat taking place, and the smoke and fresh air uniting in the great heat, the smoke is inflamed, and rendered useful in adding to the heat of the furnace; besides, this portion of fresh air is so conducted as to act partly on the kindling or kindled fuel, and raising it to a greater degree of heat after it has served its purpose, by uniting with and inflaming the smoke; and therefore is employed, in some measure, usefully, even after the coal has ceased to smoke: secondly, to the above may be added, the frame of the furnace, which is so constructed that the full-kindled fuel is kept backward in the furnace, while the fresh coal lies before, and is more gradually kindled than if introduced further among the full-kindled fuel, while the heat of the furnace is little injured or damped by the introduction of fresh coal, as is more fully described afterwards.

"The coal is admitted into the furnace by a hopper, feeder, or mouth-piece A, made of cast iron, but which may be made of other materials, and inclined to the horizon; so that the coal in it may, in some measure, fall into the fire place above the bars, as the fuel is spent; in the upper part of this hopper, feeder, or mouth-piece, is a plate *a*, placed at a small distance, or from about three-eighths to three-fourths of an inch from the upper side of the hopper, betwixt which plate and the upper plate, or side of the hopper, a stream of air rushes downward on the fire, at about half a right angle to the horizon, which stream of air assists in combusting the smoke, as before mentioned, and more fully described hereafter. B is a section of the bars, which are, in general, a little inclined to the horizon, as in the figure, that the fuel may more easily fall, or be pushed backwards in the furnace; at *c* is an opening above the bars, and below the lower end of the hopper, which is in general fitted with a grated door or doors, which open for the more convenient cleansing of the furnace, and the grated form of the doors is also designed for admitting air into the fuel, as well as at the bars, consequently the air is more concentrated in the middle of the burning fuel, produces a greater heat than if admitted only betwixt the bars; this grated form of the doors is very convenient for the admission of a poker or instrument for pushing backward the kindled fuel, while the fresh coal, or that which is not so well kindled, falls down to supply its place. In some others of these furnaces, the opening below the lower end of the hopper, and above the fore end of the bars, is left without doors at all; at this opening it is convenient, when the fire is mended, to push the coal from the fore side backward, as mentioned above, or it may be pushed backward with a hooked poker, P, by applying the hooked part of it through the furnace bars below; by either of which means the kindled coals are put backwards, while the fresh coal, or that which is not so well kindled, falls down to supply their place; that is, the coals in the situation *c*, are pushed towards *d*, while those in the situation *f* fall down to supply the place of those which were driven from *c* towards

*d*; by such means the strength or heat of the fire is not much damped by the introduction of fresh coal, and the coals which have fallen from *f* towards *c* are not so rapidly kindled as if introduced above the burning fuel; at the same time the smoke, which arises from these newly-introduced coals, passes partly through the full kindled coal and partly over, and in contact with the great heat of the burning fuel, and, meeting at the same time with the current of fresh air coming downwards, and tending also to drive the smoke still nearer to the bright kindled fuel, does, in general, completely inflame the smoke, and render it useful in adding to the heat of the furnace.

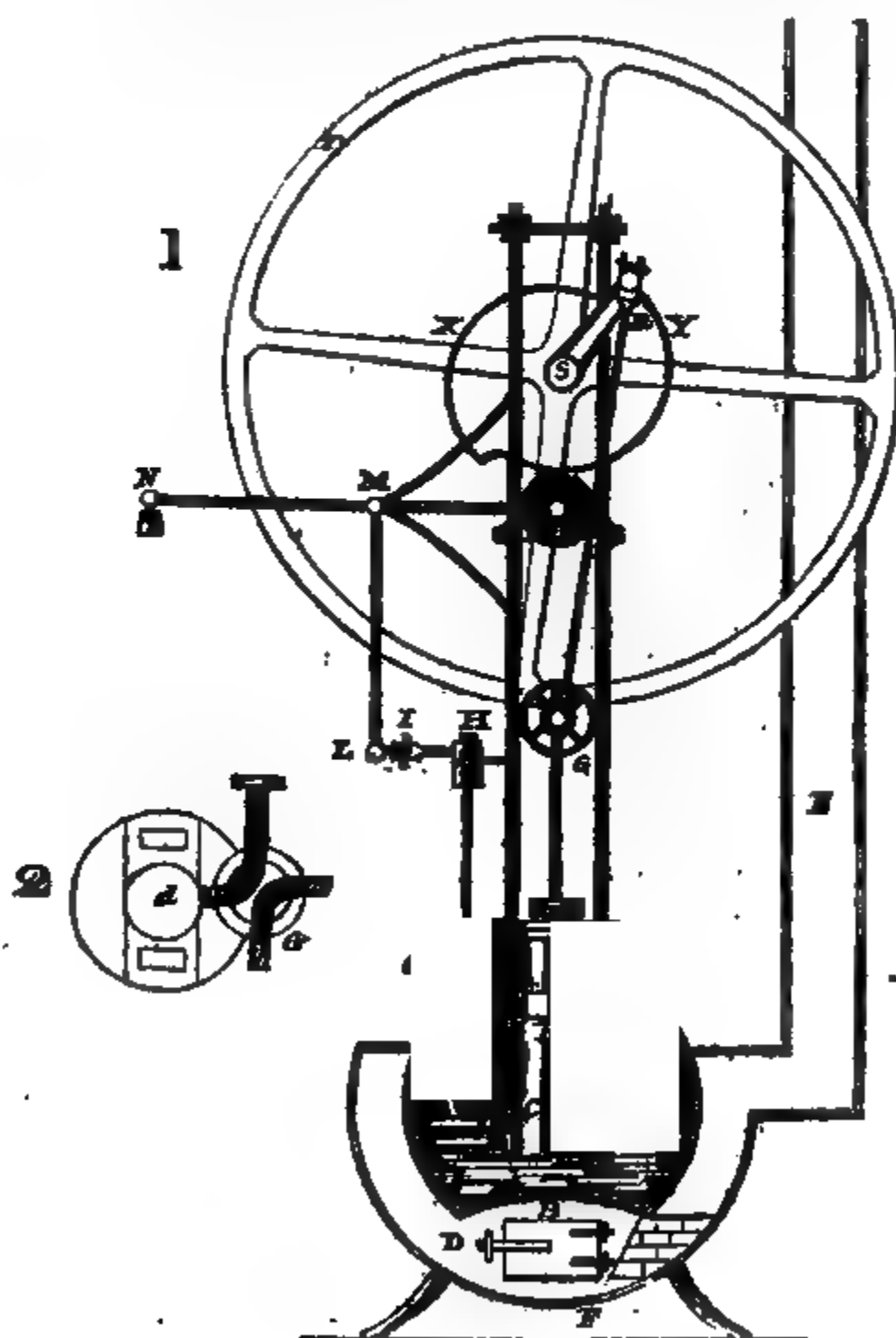
Another end obtained by the stream of fresh air, is to keep in some measure the great heat of the furnace from acting so violently on that part of the hopper which is nearest it and mostly exposed to its heat, and liable to be damaged thereby, which it does by the continual current of fresh cool air that is in contact with those parts. The construction of the furnace may be much varied, but the chief improvements are, that the fuel in combustion is supplied with air by the foreside as well as by the bars; the hopper is placed in such a situation that the kindled or unkindled coal may in part fall to the foreside of the furnace above the bars, as the other fuel is pushed backward in the furnace, and the admission of fresh air to pass over the burning fuel by means of a definite space or spaces, opening or openings, made for that purpose; so that this stream, current, or currents of air, partly come in contact with the burning fuel itself, forcing also the smoke with more immediate union with the burning fuel and great heat of the furnace. The success of the furnace depends also in a considerable degree upon what is called the draught of the furnace; that is, the chimney and flues are so constructed, that a sufficient current of air may pass through the fire to bring it to a proper degree of heat; also, that the current of fresh air may have such force as to come pretty much in contact with the burning fuel, and to convey the smoke along with it through the hottest of the flame: if this is not the case, the smoke will not be so completely consumed in these furnaces. The hopper is allowed to be kept as full of coals as possible, and either wholly or in part small coal, so as to prevent air as much as possible getting in by that passage; this must be attended to when the furnace is in its ordinary working state: yet, sometimes it is necessary to keep this opening of the hopper, either wholly, or in part open, when there is little heat wanted.

The utility of this scheme was sufficiently proved by the very general adoption which followed its publication. The combustion of smoke being now established as not only practicable, but economical, it being a fact, that all the smoke discharged from a chimney is but so much good fuel which wanted only the proper application of air to render it useful. It is equally true that the flame which is frequently at the top of furnace chimneys has no existence but there; while ascending the flue it is merely dense smoke, consisting of azote of the atmospheric air, decomposed in passing through the fire; of hydrogen, coal-tar, and carbonaceous matter, of such a high temperature that it only wants oxygen to make it inflame spontaneously: this it obtains

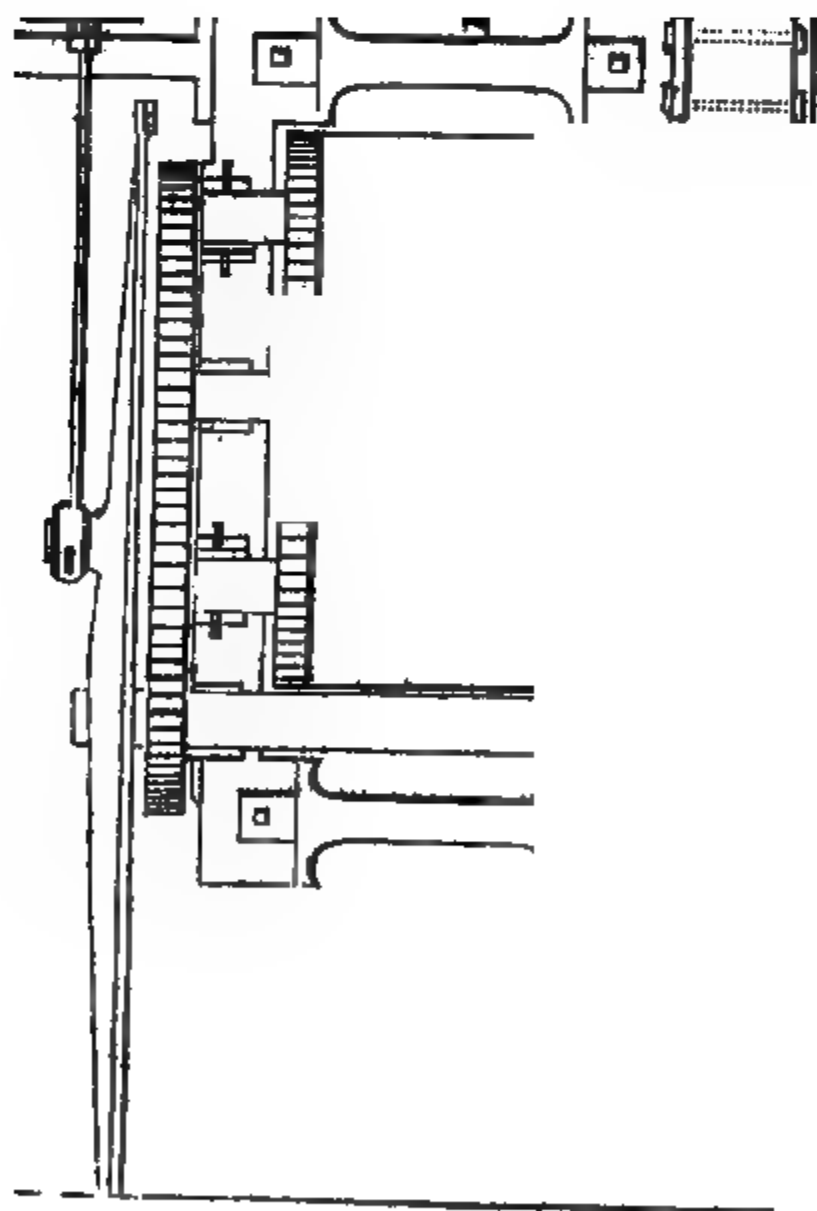
from the atmospheric air, into which it ascends, and then presents such appearances as would make a hasty observer adopt the opinion, that the flame had ascended as flame from the fuel in the furnace, which is by no means the case.

Messrs. Trevithick and Vivian's High-Pressure Engine (patented 1802) has been found the most compact, simple, and effective engine, perhaps, ever known. In an early part of this work reasons are given for the superiority of high-pressure over condensing engines, and we shall only now say that Messrs. Trevithick and Vivian's engine has, of all others on this principle, obtained the highest reputation.

"A (Fig. 1) represents the boiler made of a round figure, to bear the expansive action of strong steam. The boiler is fixed in a



case, D, lined inside with fire clay, the lower part of which constitutes the fire-place, B, and the upper cavity affords a space round the boiler, in which the flame or heated vapour circulates till it comes to the chimney, E. The case, D, and the chimney are fixed upon a platform, F, the case being supported upon four legs; C represents the cylinder, inclosed for the most part in the boiler, having its nozzle, steam-pipe, and bottom, cast all in one piece, in order to resist the strong steam, and with the sockets in which the iron uprights of the external frame are firmly fixed. G represents a cock for conducting the steam, as may be more clearly seen by observing Fig. 2, which is a plan of the top of the cylinder. *b*, Figs. 1 and 2, represents the passage from the boiler to the cock, G; this passage has a throttle valve, or shut, adjustable by a handle, so as to withdraw the steam, and suffer the supply to be quicker or slower. The position of the cock is such, that the communication from the boiler, through *b*, by a channel in the cock, is made good to *d*, which denotes the upper space of the cylinder above the piston, at the same time that the steam pipe, *a*, (more fully represented in Fig. 1) is made to afford a passage from the lower space in the cylinder beneath the piston to the channel, C, through which the steam may escape into the outer air, or be directed or applied to heating fluids, or other useful purposes. It will be obvious that, if the cock be turned one quarter of a turn in either direction, it will make a communication from the boiler passage, *b*, to the lower part of the cylinder by or through *a*, at the same time that the passage, *r*, from the upper part of the cylinder, will communicate with C, the passage for conveying off the steam. P Q is a piston-rod moving between guides, and driving the crank, R S; by means of the rod, Q R, the axis of which crank carries the fly, T, and is the first mover to be applied to drive machinery at S. X Y is a double snail, which in its rotation passes down the small wheel O, and raises the weight, N, by a motion in the joint, M, of the lever, O N, from which downwards proceeds an arm, M L, and consequently the extremity, L, is at the same time urged outwards. This action draws the horizontal bar, L I, and carries the lever or handle, H I, which moves upon the axis of the cock, G, through one-fourth of a circle. It must be understood that H I is foreshortened, (the extremity, I, being more remote from the observer than the extremity, H,) and also there is a clack or ratchet wheel on the part, H, which gathers up during the time that L is passing outwards, and does not then move the cock, G, but that, when the part X, of the snail opposite O, that is to say, when the piston is about the top of its stroke, then the wheel, O, suddenly falls into the concavity of the snail; and the extremity of L, by its return at once, pushes I H through the quarter circle, and carries with it the cock, G, and turns the steam upon the top of the piston, and also affords a passage for the steam to escape from beneath the piston. Every stroke, whether up or down, produces this effect by the half turn of the snail, and reverses the steam ways, as before described; or the cock may be turned by various well-known methods, such as the plug with pins or clamps striking on a lever in the usual way, and



the effect will be the same, whether the quarter turns be made backward or forward, or by a direct circular motion, as is produced by the machinery here represented; but the wear of the cock will be more uniform and regular if the turns be all made in the same way."

The same specification likewise describes a very simple and ingenious method of giving motion to the fly wheel, by making the piston-rod of an inflexible bar, and connecting it at once with the crank. The cylinder and boiler are allowed to vibrate on pivots, and thereby follow the revolving of the crank. The drawing here given represents also the outline of a machine for rolling sugar canes, thereby showing at once the connection of the engine with the machinery of the mill.

"The working cylinder, C, with its piston, steam pipe, nozzle and cock, are inserted in the boiler, as here delineated. The piston rod drives the fly, upon the arbor of which is fixed a small wheel which drives a great wheel upon the axis; the guides are rendered unnecessary in this application of the steam engine, because the piston-rod is capable, by an horizontal vibratory motion of the whole engine upon its pivots, O, to adapt itself to all the required positions, and while the lower portions of the chimney partakes of this vibratory motion, the upper tube, E F, is enabled to follow it by its play upon the two centres or pivots in the ring above. In such cases or constructions, as may render it more desirable to fix the boiler with its chimney and other apparatus, and to place the cylinder out of the boiler, the cylinder itself may be suspended for the same purpose upon trunnions or pivots in the same manner, one or both may be perforated, so as to admit the introduction and escape of the steam or its condensation. And in such cases where it may be found necessary, to allow of no vibratory motion of the boiler or cylinder, the same may be fixed, and guides be used. The manner in which the cock is turned is not represented in the two drawings, but every competent workman will, without difficulty, understand how the stroke of pins duly placed in the circumference of the fly, and made to act upon a cross fixed on the axis of the cock, or otherwise, will produce the motion. The steam which escapes in this engine is made to circulate in the case round the boiler, where it prevents the external atmosphere from affecting the temperature of the included water, and affords by its partial condensation a supply for the boiler itself, and is or may be afterwards directed to useful purposes."

This latter plan, namely, the vibrating cylinder, looks well in theory, but we fear in practice it would be found very imperfect. Reciprocation, as we have shown, is a great destroyer of power, and here the whole engine boiler, water, cylinder, fire grate, and all the apparatus, are constantly moving backwards and forwards, and all this, too, merely to *dispense with the guide wheel and connecting rod.*

*To be continued.*

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**METHODS OF BURNING LIME WITHOUT KILNS.**—The practice of lime-burners in Wales was formerly to burn lime in broad shallow

kilns, but in some parts they now manufacture the article without any kiln at all. They place the limestone in large bodies, which are called coaks, the stones not being broken small, as in the ordinary method, and calcine these heaps in the way used for preparing charcoal. To prevent the flame from bursting out at the top and sides of these heaps, turfs and earth are placed against them, and the aperture partially closed, and the heat is regulated and transfused through the whole mass, so that notwithstanding the increased size of the stones, the whole becomes thoroughly calcined. As a proof of the superior advantage that lime burnt in these clumps or coaks has over that burnt in the old method, where farmers have an opportunity of taking either lime at the same price, a preference is invariably given to lime burnt in heaps. This practice has long prevailed in Yorkshire and Shropshire, and is also familiar to Scotland. —*New Monthly Mag.*

**MINING.**—In the last number of the Edinburgh Journal of Science, Dr. W. Dyce has inserted an account of a cheap and effectual method of blasting granite rock. The whole process may be summed up under the three following heads;—to inflame the gunpowder at the bottom of the charge, by means of sulphuric acid, charcoal, and sulphur; to take advantage of the propelling power of gunpowder, as is done with a cannon-ball, only reversing its mode of action, and, instead of a spherical, to apply one of a conical form, by which the full effect of the wedge is given in every direction at the lower part of the charge, but particularly downwards; and, in the last place, to add to the effect of the whole, to insure a fourth part of the depth of the bore at the bottom, to be free from the gunpowder, so that when inflammation ensues, a red heat may be communicated to the air in the lower chamber, whereby it will be expanded to such a degree as to have the power of at least one hundred times the atmospheric pressure, and thereby give this additional momentum to the explosive power of the gunpowder.

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#### TO OUR READERS AND CORRESPONDENTS.

N. B. The Monthly List of Patents will be given in our next number.

The packet from Leeds is received; the Books in question will be sent by coach from hence, on Monday, the 8th instant.

A. STOWE,—W. S. D,—and TRIANGLE,—are received.

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# REGISTER

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MOREY'S REVOLVING STEAM ENGINE . . . .

VOL. IV.

x

## MOREY'S REVOLVING STEAM ENGINE.

*To the Editor.*

SIR,

I beg to inclose a brief description of the celebrated Mr. Samuel Morey's Revolving Steam Engine, as applied to navigation in the United States; should you think it possesses sufficient originality to deserve a place in your truly valuable work, the insertion of it will oblige

A CONSTANT SUBSCRIBER.

*Liverpool, 2nd Jan. 1827.*

This engine is applied in a double form to a steam boat, in the following manner.

*a a a* are the steam boilers; *b b* the tar vessels, to be afterwards described; *c* the valve box; *d d* the two revolving cylinders, shown in different positions; *e e* the piston rods; *f* the 'pitman'; *h* the centre piece; *i i* the shaft; *k k* the valves; *l l* the steam pipes; *m m* the escape pipes; *n n* the condensers; *v v* the face of the valves, shown in separate figures; *x* the tar fire.

The frame, which holds the cylinders *d d*, is suspended by its opposite sides so as to revolve. The centre-piece *h* acting as a crank, is fixed to the end of the shaft *i*, projecting over the cylinder, and from this centre-piece the bar or pitman *f* communicates with the cross piece of the piston rod. Two circular pieces or valves *k*, one of brass and the other of iron, are placed on the same axis *i*, but on the outside of the frame; one of them being fixed to the axis, and the other accompanying the frame and cylinder in their revolution. From this last valve proceed the pipes *l l*, which conduct the steam to each end of the cylinder. The valve has a smooth face, which is kept close by springs to the face of the other valve, which is fixed to the shaft. The steam is conveyed from the boilers through the outer valve into the moving valve, and from the opposite side of the outer valve proceeds the eduction pipes, which lead to the condensers.

These condensers are upright vessels, two of which belong to each cylinder; they are connected at top by a sliding valve box, by which the steam is made to enter them alternately. They have two valves at the bottom, which are kept closed by weights. A stream of water is injected into the condensers which escapes by the bottom valves *p p*, by which, also, the air is blown out at every stroke; in this manner the engine is at first cleared of air.

In order to give a reversed motion to the engine, two cocks and cross pipes are employed, for the purpose of changing the passage of the steam to the opposite sides of the valves.

When the engine is thus constructed, the steam admitted below the piston by the lower pipe *l*, forces up the piston rod *e*, and the cross piece at its upper extremity. This cross-piece carrying along with it, the bar *f*, acts upon the crank *h*, which thus gives a rotatory motion to the shaft *i i*, and of course to the cylinders and frames; the shaft *i* by means of a pinion drives the axis of the water-wheel.

With the view of saving fuel, this engine has the *Gas Fire* applied to it in the following manner: The boilers being cylindrical with an inside flue for fuel, two or three are placed close together, and set in the following manner; first, cross bars of iron are laid on the timbers; a platform of sheet iron is laid on these bars, coated over with clay, mortar, or cement to keep out the air. Upon the sheet iron, and over the bars below, are placed cast iron blocks, in shape to fit the curve of the boiler, so as to raise it three or four inches above the platform. The sheet iron is continued up the outside of the outer boilers so as to enclose them; and at one end, between the boilers, there are small grates for coal or other fuel.

The tar vessel or vessels are lodged in the space between, and upon the boilers, and a small fire may be made under them if necessary. A pipe leads steam in at one end, two pipes at the other; one near the bottom, one near the top, lead out the tar and steam. These pipes unite below; the steam and tar thus mingled, in suitable proportions, flow to the plain fire or the flues of the boilers, as well as to the coal fire below, where the gas and tar are ignited. The fireman judges of the proportions of each by the effect; the object being to produce a nearly white flame, without appearance of tar. Thus flame is applied to the greatest possible surface, and the apparatus adds very little cost to the engine.

Mr. Morey has also made two other improvements in the boiler. The first of these consists in lining or covering the flue within with sheet iron or copper, perforated with small holes, reaching down its sides nearly to the bottom. By this contrivance the water is made to circulate rapidly between the flue and the lining, up to the top of the flue, and thus protects it from being run dry, or heated red hot, when the water gets by accident too low. In consequence of this circulation, the lining causes the steam to form much faster.

The other improvement consists in an interior boiler or vessel, occupying the back part of the flue, and communicating downwards with the water, and upwards.

Several engines of Mr. Morey's construction have been erected. The Hartford steam boat, 77 feet long, 21 feet wide, and 136 tons, is propelled by one of them. In this vessel, the engine with its boiler occupies a space of 16 feet by 12, or one-eighth part only of the boat; the cylinders being hung in the timbers of the deck over the boilers. The two cylinders are 17 inches each in diameter, and have a stroke of 18 inches, and revolves 50 times in a minute. The area of the piston being about 227 inches, it will, when worked with steam of 50 lbs. have the power of 100 horses.

### **DUESBURY'S PATENT WHITE PAINT.**

THE white sulphate of barytes has for several years been employed in preparing a very useful pigment, termed *constant white*. Mr. Duesbury's improvement consists in a process by which the impure native sulphate of barytes, may be employed for the same purpose. The colour thus made by the Patentee, having been found

unsusceptible of change from exposure to the air, is valuable for many purposes, but especially for paper hangings; it may be used with advantage as a pigment in oil, but more properly as a water-colour.

The impure native sulphates of barytes (commonly known by the several terms of *cawk*, *heavy-spar*, *terra ponderosa*, *vitriolata*, *marmer metallicum*, &c.) are to be picked and washed from impurities, then pulverised, or ground in a mill with water. Thus prepared the material is to be put into a leaden boiler. Being made to boil, sulphuric acid must be added from time to time until all the iron in the mineral be dissolved, which is ascertained by its attaining a brilliant degree of whiteness. During the boiling the materials are to be frequently stirred: after the boiling, the white product is to be repeatedly washed in water, to remove what may remain of the iron in solution. Other acids that will dissolve iron will answer the purpose, but none are so advantageous as the sulphuric, in the opinion of the patentee; should any other be used, due attention should of course be paid to the material of which the boiler is composed, which might be acted upon chemically by the acid, to the disadvantage of the pigment as well as the boiler.—Mr. Duesbury is a colour manufacturer, at Bosel, Derbyshire.

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### AYTON'S IMPROVED FLOUR BOLTING MILLS.

THE bolting mill is that part of the machinery of a flour mill to which the bolting cloth is affixed, for sifting or "dressing" the flour. It is generally composed in the way hitherto used, of six bars of wood, united by arms passing through an axle, forming therewith the framing of a cylindrical reel; over this the bolting cloth, of considerably larger diameter than the reel (which is about 22 inches) is fixed. At each end of the bolting cloth a band of leather is sewed, to strengthen it; and at the upper end a drawing string is inserted, for the purpose of confining it on the rim at the head of the reel. At the bottom of the bolting cloth six loops are attached, each of which is brought to the end of each bar, where it drops into a notch made to receive it, and thus fixes the cloth at the tail of the reel. The reel is placed in an inclined position, and made to revolve rapidly within six bars of wood, called beaters, fixed to the box or case which contains the reel, at about half an inch distance apart from the bars of the reel. The reel being turned with great velocity, the centrifugal force would throw out the bolting cloth to its utmost extent were it not intercepted by the beaters; the repeated blows from which forces the flour through the interstices of the cloth, that would otherwise soon become choked up. Owing to the inclination of the reel, and a constant uniform stream of meal entering it, the flour is first separated from it, and subsequently at the "tail" end of the lever, the "offal," consisting of "bran, pollards, and sharps."

The complete success of this operation depends very much upon two particulars; the rapid and powerful vibration of the bolting cloth, and the equable manner of its action upon the beater. Both

of these requisites, according to the present methods of fastening the loops to the bars or the reel, are very imperfect; the want of elasticity in the cloth, the stretching of the leathers and the loops, and from various other causes, the work is performed slowly; and when the reel is going at a great rate, and the meal is not regularly supplied, the bolting cloth becomes injured, and is not unfrequently torn to pieces.

To obviate these inconveniences, the patentee proposes the adoption of a series of springs, capable of easy adjustment, which proceeding from a common centre, like the radii of a wheel, receive the loops at the tail of the bolting cloth, and thus give at the same time that degree of tension and elasticity which is necessary to produce a uniform and powerful vibration of the bolting cloth.

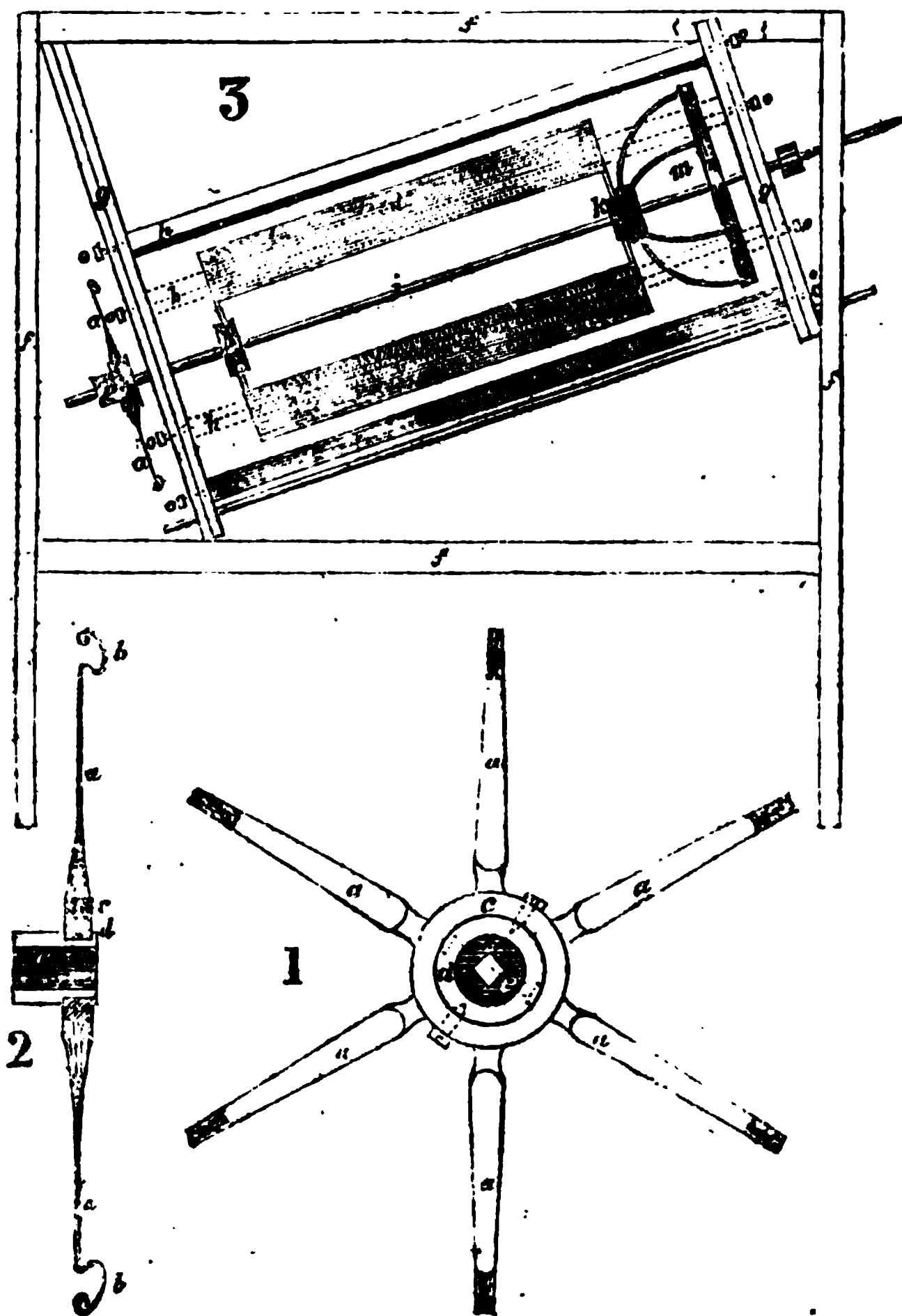


Fig. 1. is a plan or front view of the six steel arms or springs, *a a a a a a*, riveted to a ring of metal *C*. Fig. 2. gives a section of Fig. 1.; and Fig. 3. gives a side view of an improved bolting machine complete, excepting that certain obvious parts are removed to prevent obstruction to the light. The letters in each Fig. refer to similar parts.

As the six spring arms are alike, their breadth is seen by Fig. 1. but the other points of their figure are better understood by reference to the section, Fig. 2, which gives an edge view of two of them, and shews that their extremities are formed into broad hooks *b b*, to receive the loops of the bolting cloth, and are for that purpose nicely rounded and smoothed. The other ends of the springs are shown rivetted through the ring *C*, which ring is fastened to an interior ring *d*, by means of two conical pointed screws (shewn in Fig. 1); the ring *d* is in like manner fixed to the central socket *e*, by means of two other conical pointed screws, which standing at right angles with the other two screws, form, by their combined action, a kind of universal joint, upon which the steel arms are easily adjusted to the required position.

*fff*, Fig. 3. represent the exterior frame of an improved bolting machine; *g g* the end plates of the internal apparatus, which is drawn in an inclined position; *h h* the beaters, two of them being in front are shewn in dotted lines; this part of the machine is fixed: *i* is a revolving axis, on which is fixed the two "maces," *k k*; from each mace, four arms or spokes radiate at equal distances; from each arm on the one mace, is fixed a strip of duck cloth, five or six inches wide, which extends longitudinally along the reel, and is then fixed to the opposite arm on the other mace, as shewn at *l l*: the uppermost mace is also fixed on the axis *i*: a light semi-spherical frame, over which the bolting cloth is drawn and made fast to the circular rim, *n*, by the running string before-mentioned; the loops to the "tail-leather" at the other end of the bolting-cloth, are fixed to the hooks of the spring arms *a a*, already particularly described in Fig. 1. & 2., and shewn in Fig. 3. in its place on the axis *i*. Thus the most perfect and equal tension will be effected upon the bolting cloth, and the beaters being adjusted to a proper distance, the operation will be effectually performed.

Various circumstances occur which render a peculiar adjustment of these parts necessary; the patentee has adopted a very simple and ingenious mode of effecting it. Our space does not admit of a very particular description of this part of the apparatus. It is effected by the turning of two cast-iron plates, which are let flush into the head and tail boards; these plates are in pairs, one of them having a series of eccentric grooves or slits, and the other a series of similar grooves, but in a direction nearly radial; through these grooves the cylindrical pins *o o o* pass, and are fixed into the beaters, so that when the external plate at either end is turned by means of a pinion (and winch), which takes into a few teeth on the periphery of the plate, the beaters are simultaneously moved gradually nearer to or further from the bolting cloth, with the utmost facility.

When a rapid motion is given to the reel, the pieces of duck, &c., set the air in brisk motion, by which much of the flour is forced through the cloth, the tension and tremulous motion of which, by the elasticity of the springs, tend to prevent the clogging up of the interstices of the cloth, and the operation of bolting proceeds regularly, without being attended with the inconveniences and defects before pointed out. By the employment of this new apparatus, we are informed, *that nearly double the quantity of meal is bolted in a given time.*

## MR. VALLANCE'S NEW MODE OF PROPULSION

BY THE AIR IN A TUNNEL.

IN our 18th and 19th Numbers we gave a descriptive outline of Mr. Vallance's extraordinary scheme for rapid travelling and transmission in a tunnel; in the practicability of which our faith has always been strong, notwithstanding the ridicule that has been thrown upon it. It is, therefore, extremely gratifying to us to find that the bold genius which projected the astonishing scheme, has actually put it into practice at Brighton, on a scale sufficiently extensive to demonstrate its feasibility and its immense advantages. The following report on the subject, lately published in a diurnal print, appears to us to be of a too interesting and important nature to be omitted in a work professedly a Register of Improvements in the Arts.

Report from a Staff Officer in the Corps of Engineers, Chevalier of St. Vladimir, &c. &c. who was selected by his Imperial Majesty the late Emperor of Russia, to examine and report upon all the Inland Communications, &c. &c. throughout the United Kingdom,

"To His Royal Highness Prince Alexander, Duke of Württemberg, Chief of the Corps of Engineers for the Inland Communications of Russia, General of Cavalry, &c. &c. &c.

"Your Royal Highness having commanded me to report upon all the inventions of importance that have been brought forward in England of late years, whether such were or were not named in the instructions I had the honour to receive from your Royal Highness in St. Petersburg, in June, 1824, I beg leave most humbly to submit the following particulars, relative to a proposed mode of conveyance; differing from every existing system, as much as it will surpass them in point of expedition and ultimate economy.

"In March, 1825, I was informed, that a Mr. Vallance had invented a method of conveyance, by which goods might be forwarded from place to place ten times faster than can now be done; or equal to 100 miles per hour. The apparent absurdity of the proposition, and the undefined explanation then given, induced me to consider the scheme as one of the nefarious and stock-jobbing bubbles of the day; consequently I took no measures to become correctly informed on the subject; particularly as I was about leaving London for an extensive journey in the interior. Recent circumstances have, however, caused me to entertain so different an opinion to that which I then held on the subject, that I can now confidently submit to your Royal Highness an account of a method of conveyance, which will, in my humble opinion, within a few years, operate a change in the condition of the whole civilized world; and would be productive of the most important benefits to the Russian Empire.

"The theory of this method is stated in the Treatise marked with the letter A. The practice I have experienced personally: having been conveyed over a space sufficient to demonstrate the practicability of the principle; and although that space was not sufficient to admit of any such velocity being

attained as is adverted to in the Treatise, yet there is sufficient evidence of the velocity with which air may be made to move, to satisfy any one that on a line of proper length, the only limit to the rate at which persons or goods may be conveyed, will be that at which wheels will revolve. I will, however, first advert to the general object of the Treatise, and then comment on those parts of it which I conceive to require further illustration.

"Your Royal Highness will perceive, upon a perusal of the Treatise, that the general object of the author is to prove,

"1. That it is practicable to render air a means by which we may cause a peculiar sort of wheel carriages to convey both passengers and goods ten times faster than horses can draw any vehicle now in use.

"2. That this may be done with perfect safety and convenience.

"3. That we may, at one and the same time, move a weight exceeding that of 100,000 infantry, or 10,000 cavalry; and, consequently, that a whole army may, in an hour, be transported over a space of 100 miles.

"That this method of transmission may be put in practice, for an expence per mile far less than what several canals have cost, as will be apparent from the amounts of the several inland navigations of the United Kingdom, stated in my Report of January last.

"5. That the expence of transport by it will be so many times less than by any present method, that military as well as commercial benefits will result from it of the most important nature; and

"6. That the stoppages, inconveniences, and delays, which would otherwise arise from those who have charge of the exhausting apparatus at each end of the line of transit, setting it in operation at an improper time, may be prevented by the new mode of telegraphic communication described\* in the last section of the Treatise, which, being equally efficient during the most foggy weather and darkness, as in day light and clear weather, will admit of instantaneous communication between those who direct the operations at each end; so that anything, it may be necessary should be known at one end, may be instantaneously communicated from the other, independent of the method of conveyance itself; an arrangement, without which the operation of the principle would ever be attended with doubt, delay, and danger.

"The vast importance which a method of transmission, combining the advantages of tenfold expedition and cheapness, must be, to an empire as extensive as that of Russia, I will not presume to point out to your Royal Highness, but pass to those particulars which appear to me to require further elucidation than the author's object allowed of his giving.

"The first thing is, the velocity at which the cause of motion, in this method of transmission, viz. the air, would move us, provided we could construct wheel carriages to go so fast. This velocity would, if raised to its maximum, be between 900 and 1000 miles an hour. But as saving nine-tenths the time now wasted in travelling post, would render the saving of portions of the remaining tenth, very unimportant, it will be unnecessary to trouble your Royal Highness with proof that it might be possible to do so, in perhaps a large proportion; and I, therefore, pass to the adduction of evidence, which shows that it is certainly in our power to save nine-tenths.

"From the examination I have given to the construction, and what I have experienced as to the effect of the cylinder, or large tube, in which I was conveyed, according to this principle of transmission, I am convinced that exhaustion, to a degree which should give fifteen inches of mercury, may be effected—that is, half a vacuum; and as this would give an initial velocity of between 200 and 300 miles an hour, there is no reason to doubt but that a rate of motion equal to 100 miles an hour may be attained, provided wheels can revolve so fast without igniting. The operations of nature frequently impart to air a velocity of above 100 miles an hour; and in the process of fusing iron, it is artificially caused to move at rates varying from 200 to nearly 700 miles an hour. At the lower rate of 100 miles an hour, it must therefore be fully practicable to make it move.

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\* All the details of this very ingenious invention, with illustrative engravings, are given in the 41st and 42nd Numbers of The Register of the Arts and Sciences.

"The second thing I advert to, is the quantity in which air may be exhausted, or taken out of a cylinder; or line of large pipe, such as is adverted to. The blast cylinders used instead of bellows, for fusing iron, are all air pumps, and it is requisite only to arrange the valves properly, to render them condensing or exhausting pumps at pleasure. Many of these pumps are large enough to exhaust 10,000 cubic feet of air per minute. Assuming the area of the cylinder to be 100 square feet, and the velocity at which we are to be conveyed to be 100 miles an hour, the combined operation of 88 of these pumps would be required. But the one referred to in page 18, will take out 22,000 cubic feet per minute; therefore, only 40 such pumps as *that would be required to exhaust* air from the cylinder at the rate of 100 miles an hour—a number, the operation of which there will be no difficulty in combining.

"The pressure requisite to cause air to move at the rate of 100 miles an hour, appears, by all experiments that have been made on the subject, to be less than half a pound per square inch. Calculating from this datum the power requisite to move a column of air equal to the area of the cylinder, at the rate of 100 miles an hour, would be that of 1,900 horses.

"A steam engine of fifty horses' power would, therefore, be required to each air pump, to cause the air to move at the rate of 100 miles an hour, independent both of the load to be moved, and of the friction of the air against the inside of the cylinder. With reference to the first of these—the load to be moved—it is to be observed, that, owing to the principle combining the operation of by far the best railway I have ever seen, or, indeed, can conceive, with carriage wheels six times as high as those used on the patent single line railway; friction is diminished to a degree which will admit of the same power moving a considerably greater weight than on that railway. It will, therefore, be quite safe to calculate only on the same effect being produced; and, according to this, the extra power requisite to move 100 tons at the rate of 100 miles an hour, would be only 200 horses. With reference to the friction of the air against the inside of the cylinder, as referred to at pages 68 to 74, several times the power will be required; so that, were there no other means of power and exhaustion than steam engines and air pumps, objections might arise in point of expence. But, by what is stated at pages 50 and 51, it appears that neither air pumps nor steam engines would be indispensably necessary; and although Mr. Vallance does not at present deem it prudent to give full explanation on this particular, he informs me that whenever it may be requisite, he is prepared to prove that every purpose of exhaustion may be effected without other apparatus than what he can construct out of rough hewn trunks of trees; so that the question may be considered free from any objections which the necessity for costly machinery would give rise to in Russia.

"Thirdly, that a vehicle capable of carrying both passengers and goods, can be so adapted to the inside of the cylinder as to be moved in it by the air when operated upon by the air pump, I can vouch, from having seen and experienced it; and as the rate at which this vehicle moves is exactly commensurate with that at which the pumps exhaust air from the cylinder, it follows, that, at whatever rate air can be pumped out of the cylinder, the vehicle will be carried forward, provided that velocity does not exceed the rate at which wheels can revolve on their axes without ignition: with reference to which, it is to be observed,

"Fourthly, that the number of revolutions made by a carriage wheel depends on the size of that wheel, as well as on the motion of the vehicle. The fore wheels of the coaches which travel with the greatest expedition, revolve, on an average, about 100 times in a minute. One of the peculiar advantages of the method Mr. Vallance proposes is, that it admits of the wheels of the vehicles which move in the cylinder, being several times larger than the wheels of carriages which run on roads: owing to their being always kept in an exactly perpendicular position, and consequently free from the strain thrown on the spokes of a common carriage wheel, by the deflections from the perpendicular, which the nature of and obstructions upon roads continually occasion. Owing to this, the wheels of the vehicles which move in the proposed cylinder, may be from ten to twelve feet in diameter; or nearly four

times as large as the fore wheels of a coach. The same number of revolutions, therefore, which the fore wheel of a coach makes in an hour, would move the vehicle in the cylinder forty miles; and twice and a half that number of revolutions would give one hundred miles an hour. Now if a common coach wheel, which moves under the disadvantages of being constantly exposed to all the clogging and impediments arising from the dust and dirt of the road, can revolve for hours together at the rate of one hundred times a minute, without being greased, excepting at the end of its journey of perhaps one hundred miles, it may fairly be presumed, that a wheel, which would be not only free from all dust and dirt, but also moving in a reservoir of oil would revolve 250 times a minute without heating, even had we no such evidence as that referred to in page 36. But when that is taken into the consideration, all anxiety with reference to the effect a velocity of 100 miles an hour would have on the axes of the wheels, may be dismissed.

“Fifthly, nor is it necessary that any anxiety should be entertained, as to the effect such a velocity would have on respiration; for in addition to what is urged on this matter at pages 28, 29, and 35, I have to state that, though I was purposely exposed to the ‘vacuum’ as it is termed, many times during my examination of, and riding in the cylinder, yet I did not experience the least inconvenience from it. Indeed, I should not have been aware of it, had my attention not been directed to it; the degree of exhaustion, necessary to move the carriage, not being much more than the ten-thousandth part of a vacuum: a diminution of density, which would not lower the barometer so much as the two-hundredth part of an inch.

“Sixthly, a degree of exhaustion, or vacuum, which is not sufficient visibly to affect the barometer, being enough to move the carriage with persons in it, so as for them to experience the effect, and fully comprehend the operation of the principle, it becomes evident that the idea at first entertained of a perfect vacuum being indispensable, is most erroneous; and the objections which at first present themselves to us, relative to the difficulty of constructing the cylinder—of making the joints air tight, and of so adapting the ends of the vehicle to the cylinder, as should prevent the passage of any important quantity of air, without occasioning great friction, are all seen to exist only in imagination. In the cylinder which Mr. Vallance has in operation at Brighton, there is a space of above an inch in width, purposely left all round between the cylinder and the end of the carriage which forms the piston, against which the air presses to drive the carriage along; yet does not the air which rushes through this crevice (though it is in the whole equal to an aperture of two square feet), prevent the operation of the principle; its sole effect being a loss of a proportion of the power employed to drive the air pumps; a loss which Mr. Vallance intentionally submits to, for the sake of proving that a very large portion of air may rush by the piston end of the carriage, without preventing the effect of the principle.—Vide pages 30 and 31.

“Seventhly, nor will the degree to which it may be necessary to exhaust, or, as it may in other words be termed, the degree of ‘vacuum’ required, to move even a very great weight, interpose any insuperable difficulty. In the cylinder at Brighton, a party, consisting of his Grace the Duke of Bedford, the Earl of Lauderdale, Lord Holland, Lord W. Russell, Lady W. Russell, and another lady and gentleman, were all at the same time experiencing the operation of the principle, on the day I was last at Brighton, with a degree of exhaustion not exceeding two drachms per square inch; a proportion of vacuum which would lower the barometer about one-hundredth of an inch. Practice therefore proves, as well as the arguments in pages 47 and 48, that a very trivial degree of exhaustion will be sufficient to move a considerable load; and as it will be perfectly practicable to exhaust to a degree, that should render a barometer exposed to the vacuum inside the cylinder, several, if not many inches lower than one would stand exposed to the atmosphere, I do not think the amount stated in page 37 more than it may be possible to move at one time. And with reference to weights of 50 or 100 tons, such as loco-motive engines draw at once, there will certainly be no difficulty at all, let the velocity they are moved at be what it may.

“Eighthly, under the trivial degree of exhaustion which will thus,

generally speaking, be necessary, your Royal Highness will perceive, that rendering the cylinder sufficiently air-tight for the purpose, will be far less difficult than it is at first supposed. Indeed, I see so many different ways of doing it, that I am satisfied it would not, in practice, prove more difficult, nor indeed so difficult, as causing some canals I have seen to retain the water let into them.—Vide p. 45.

“Ninthly, nor will there be any difficulty in regulating the motion of, and stopping the vehicle. The shortest way of rendering this evident to your Royal Highness, will be to suppose the end of the carriage which, when in motion, stands across the cylinder, at a right angle with its course, to be capable of turning on a pivot; so that it may be moved one quarter of a circle, and placed in a line with the course of the cylinder: or edge to wind, like a sail when it shivers. The consequence of this would be, that as the air would pass by without pressing against it, the power which moved the carriage forward would be taken off; and as the wheel could at the same time be dragged by a friction lever, while other levers caused friction against the side of the cylinder, the progress of the carriage could be commanded and stopped at pleasure. This method of removing the effect of the pressure of the air against the carriage, not being that which would be made use of in practice; my reason for adverting to it, is solely to enable your Royal Highness to perceive, that a very simple arrangement will admit of its being done. For the same reason, I only state, that, to the axis of each carriage, would be connected clock work, which would show the person who has charge of the carriage how far he has gone, and where he is, to a yard, so that there will be no uncertainty as to when and where to prepare for stopping, by gradually diminishing the motion of the carriage. There will be every facility for perfect vision, as at each end of every carriage will be fixed a portable gas light.

“Tenthly, this principle possesses an advantage over common roads, as well as rail-roads and canals, which will, under all circumstances, be generally, and in some cases, highly important. This advantage is, that the cause of motion (the atmospheric pressure) will act vertically as well as horizontally; and that in consequence of it, the filling up of hollows, and also deep cutting, as for canals and rail-roads, is unnecessary. Not that it would be advisable to select hilly ground; though perfectly possible to go over any, the most abrupt rises, even were they nearly perpendicular. But that any rise or fall over which a carriage road can be cut, would be quite level enough for the operation of the principle.

“Eleventhly, I now mention the expense per mile, which I think will not in Russia exceed 10,000*l*. The calculations on which this opinion is founded, I do not here submit to your Royal Highness; but at such time as may be necessary they will be ready for transmission.

“Twelfthly, the expense of transit, or carriage, by this principle: assuming that the combined effect of the improved rail-way in the cylinder, and the six fold diameter of the wheels, should not render any given power capable of moving more than on the single-line railway (*vide* my Report of August, 1825), one horse would move twenty tons; but independent of the effect which the wheels, being six times larger, would have in diminishing friction, the expense of transmission would be diminished many times, from the following circumstances:—On the single line railway, the power employed is that of horses; and considering the construction of that railway, and the height the rail must be in some situations above the ground, I do not conceive that locomotive engines can be ever used upon it. Horse power is 24 times as dear as elementary power employed in the way the treatise points out. Assuming, therefore, that the friction of the rarefied air against the inside of the cylinder, as stated at pages 68 and 74, should increase the power required ten times, still would the expense of carriage be less than by the single line railway, while we should attain the important advantage of being able to transmit 10,000 tons, at any rate between what railways now transmit at, and 100 miles per hour, for an expense which, as relates to power, would be only the twenty-fifth part of a farthing per ton per mile.

“But even were the friction of the rarefied air against the inside of the

cylinder to increase the power required ten times, as I have supposed, it is not imperative that the expence of transmission must be increased in a similar degree. Owing to its being well known and universally received, steam is the first mover or power Mr. Vallance has referred to. The researches of men of science in England have, however, been for some years directed to means of rendering the gases first movers, instead of steam, under the hope of obtaining an agent, which should serve as a mechanical first mover, without fuel. From the year 1820, the attention of Mr. Vallance has been directed to this subject, with a view of rendering the method of conveyance the Treatise refers to perfect, in the particular of cheapness of transmission; and about two years ago he obtained a patent for a first mover, which will give ten times the power of steam, without any expence for fuel; the principle of which is stated in the Tract, marked letter B, which I have obtained from him, for the perusal of your Royal Highness.

"The power therein referred to, proposed to be used instead of steam, would so greatly reduce the expence of transmission, that the cost of power would be ten times less than by the single line rail-road. It will also be equally superior in point of safety and security from accidents, as it is in point of economy and expedition; it being, as stated in page 81, absolutely impossible to be overturned. Thus combining expedition exceeding that of posting, with economy equal to that of canal transmission, it must appear that this principle is most importantly advantageous to an empire so vast in its extent as that of Russia, and, consequently, fully authorises me most strongly to recommend that the government should immediately contract with Mr. Vallance, to send a practical illustration of the principle, such as he has in operation at Brighton, which being capable of carrying your Royal Highness, the Members of the Council, and Generals of the Arrondissements, over a space sufficient to demonstrate the practicability of the proposition, will place within command a reply to all objections from ignorant or interested persons.

"It has been deemed essentially important to the welfare of Russia, to promote internal communications by canals, and immense sums have been expended in cutting them; but owing to the long duration of winter, they are useless during half the year, and so slow is the rate of transmission by them, that, even when in full operation, they can hardly serve to convey goods from one part of the empire to the other, before winter locks them up again. Railways also, owing to the period the snow lays on the ground, and the continual drifting of it which takes place, would be available scarcely more than half the year.

"But the principle here adverted to, being neither liable to interruption from either frost or snow, and equally effective by night as by day, offers a means of rendering the extremities of the empire contiguous to each other; and will do this at a much less charge than can ever be done by canals, or any other mode of conveyance. The vast importance of this principle to Russia, both in a military and commercial point of view, it is unnecessary for me to state to your Royal Highness; but I consider the manifold advantages it presents sufficiently demonstrated, to prompt me to recommend its speedy adoption, from St. Petersburg to Tsarsko-selo, the river Volga, Moscow, and the Black Sea.

"London, Dec. 21, 1826.

"WILLIAM COULING, K.V. &c."

## **History of the Steam Engine, Chap. V.**

*Continued from p. 303.*

Messrs. Trevithick and Vivian propose in the same specification to use their engine for the purpose of travelling on the common road. The carriage resembles in form the common stage coach; an iron frame, containing the boiler and cylinder, is placed behind the car-

riage; the cylinder is likewise horizontal. Our readers will readily see the application of the preceding apparatus to the wheels by a cranked axle. On both ends of the axle cog wheels are fixed, by which means, when the axle is made to revolve, it communicates its motion to the hinder and larger wheels of the carriage. The machine has a fly wheel, to preserve the regularity of the motion: means are also provided for throwing any of the wheels out of gear, by which a turn can be made without difficulty.

It appears that, in the year 1804, Mr. Trevithick had an opportunity of proving the utility of his Locomotive Engine upon the Merthyr Tydvil Rail-road, South Wales. The engine had a cylinder of 8 inches diameter, and a stroke of 4 ft. 6 in. in length, and drew after it upon the rail-road as many carriages as carried ten tons of bar iron, from a distance of nine miles, which it performed without any supply of water to that contained in the boiler at the time of setting out; travelling at the rate of five miles an hour.

Mr. Matthew Murray, of Leeds, obtained a patent for a Portable Engine, in 1802, which displays much novelty and ingenuity.

“ Figs. 1 and 2 represent front and side views of the combination of parts of this engine. A the steam cylinder; B the piston rod; C C, connecting-rods, for connecting the piston rod to the pin in the wheel D; E a wheel, fixed to the side of the cistern, I I I I, with the teeth inwards, to admit the teeth of the wheel, D, for the purpose of giving a parallel direction to the rods, C C; F a plain wheel, upon the fly-wheel shaft, G; the wheel, F, is furnished with a double conical centre for the wheel, D, to run upon; I I I I is a cistern or frame of plates, on and in which the whole combination of materials constituting this engine is fixed; K K two wheels, one upon the fly-wheel shaft, G, the other upon the crank shaft, L; these wheels and crank are for the purpose of working the lever, R, in Fig. 2, which lever gives immediate motion to the air-pump, P, and the cold and hot water pump; T is an iron bar for supporting the shaft; M is a slide valve for opening and shutting the communication of the steam pipes, marked N N N, and is described in Figs. 3, 4, 5, 6, and 7; a motion for the slide valve is taken from the crank shaft; L, by levers, or otherwise, as the nature of the valve may require. The parts so combined form a perfect engine, without requiring any fixture of wood, or any other kind of framing than the ground it stands upon, which is transferable without being taken in pieces, (the motion of the fly-wheel shaft giving circular power to any process or manufactory requiring circular motion,) or irrigating land, or for the various purposes of agriculture. Figs. 3, 4, 5, 6 and 7, represent various forms of the new slide-valve in its application to the steam-engine; the principle of which consists in moving in a circle part of a circle or straight line, by means of flat surfaces or faces (or nearly so) sliding or moving upon each other, for the purpose of uniting the necessary apertures in the steam pipes or cylinders. Fig. 3 is a view of a circular flat sliding valve; the dotted lines show the avenues to the steam pipes. a l is a figure representing the upper or moveable part of the slide valve, Fig. 3, where the conducting or uniting cells



are formed: there is a circular spring for compressing *a* 1 to the face of the slide valve in Fig. 3, so as to render them perfectly steam and air tight, which perfection they will naturally acquire by constantly rubbing upon each other. Figs. 4, 5, 6 and 7, show four varieties of the slide valve, for working double or single powers. *a* 2, *a* 3, *a* 4, and *a* 5, contain the cells for conducting to the different apertures or steam ways. Any further description is unnecessary, as the drawings will convey to any one the principles of these inventions."\*

This ingenious apparatus, though possessing much merit, infringed, it appears, on the patent right of Messrs. Boulton and Watt, and the patent was, therefore, repealed in 1803. An engine on this plan has been at work many years at St. Peter's Quay, on the river Tyne, and is found to answer uncommonly well.

Mr. Woolf's very excellent and ingenious boiler (patented 1803) comes next under our notice. The great utility of this apparatus induces us to give the specification, together with Mr. Woolf's own remarks in full.

"Mr. Woolf's improved apparatus consists, first, of two or more cylindrical vessels properly connected together, and so disposed as to constitute a strong and fit receptacle for water, or any other fluid intended to be converted into steam, whether at the usual heats, or at temperatures and under pressures uncommonly high; and also to present an extensive portion of convex surface to the current of flame or heated air or vapour from a fire. Secondly, of other cylindrical receptacles placed above these cylinders, and properly connected with them, for the purpose of containing water and steam, and for the reception, transmission, and useful application of the steam generated from the heated water or other fluid. And, Thirdly, of a furnace so adapted to the cylindrical parts just mentioned, as to cause the greater part of the surface of all and each of them, or as much of the said surface as may be convenient or desirable, to receive the direct action of the fire, or heated air and vapour.

"One of his boilers, in its most simple form, consists of eight tubes, made of cast-iron or any other fit metal, which are each connected with a cylinder placed above them. The fuel rests on the bars, and the flame, heated air, and vapour, being reverberated from the part above the two first smaller cylinders, goes under the third, over the fourth, under the fifth, over the sixth, under the seventh, partly over and partly under the eighth small cylindric tube. When it has reached the end of the furnace it is carried to the other side of the wall, built under and in the direction of the main cylinder, and then returns under the seventh smaller cylinder, over the sixth, under the fifth, over the fourth, under the third, over the second, and partly over, and partly under the first; when it passes into the chimney. The wall before mentioned which divides the furnace longitudinally, answers the double purpose of lengthening the course which the flame and heated air have to traverse, giving off heat to the boiler in their passage, and of securing from being destroyed by the fire the flanges or other joinings employed to unite the smaller tubes to the

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\* Specification of Patent.

main cylinder. The ends of the smaller cylindric tubes rest on the brick work which forms the sides of the furnace, and one end of each of them is furnished with a cover, secured in its place by screws or any other adequate means, but which can be taken off at pleasure, to allow the tubes to be freed from time to time from any incrustation or sediment which may be deposited in them. To any convenient part of the main cylinder a tube is affixed, to convey the steam to the steam engine, or to any vessel intended to be heated by means of steam.

*To be continued.*

#### LIST OF NEW PATENTS, SEALED.

**LAMPS.**—To T. Machell, Esq. of Roper's Street, Oxford Street, for improved apparatus for burning of oil and other inflammable substances.—8th December. Six months.

**CASKS & PACKAGES.**—To R. Dickenson, Esq. of New Park Street, Southwark, for improved packages for holding and preserving liquid and solid substances.—15th December. Six months.

**APPLICATION OF HEAT.**—To Charles Pearson, Jun. Esq., of Greenwich, Richard Witty, of Hanley, Staffordshire, and William Gillman, of Whitechapel, for improved methods of applying heat to certain purposes.—15th December. Six months.

**MINING.**—To Charles Hasleben, Esq., of Great Ormond Street, for improved machinery for the working of mines, and facilitating the extraction of diamonds and precious stones, and metals from the ore, earth, or sand.—15th December. Six months.

**STEAM MACHINERY.**—To John Oostigan, of Colton, Louth, Ireland, for improvements in steam machinery.—15th December. Six months.

**DURABLE INSCRIPTIONS.**—To Peter Mackay, of Great Union Street, Borough, for an invention by which the names of streets and other inscriptions will be rendered more durable and conspicuous.—15th December. Six months.

**SALT.**—To William Johnson, of Droitwich, Worcestershire, for improvements in the process and form of apparatus for "manufacturing salt."—18th December. Six months.

**SPINNING.**—To Maurice de Jongh, of Warrington, for improved apparatus, for roving, spinning, twisting, winding, &c. fibrous substances.—18th December. Six months.

**SHIP-BUILDING.**—To Charles Hasleben, Esq. of Great Ormond Street, for improved construction and mode of propelling ships and other vessels.—20th December. Six months.

**LAMPS.**—To Thomas Quarrell, of Peter's Hill, Doctors' Commons, for improvements in the manufacture of lamps.—20th December. Six months.

**SHIP-SURVEYING.**—To W. Kingston, and George Stabbing, of Portsmouth, for certain apparatus for ascertaining the time and stability of ships and other vessels.—20th December. Six months.

**CLEANING RICE.**—To Mabel Wilson, of Warfords Court, London, for certain improvements in machinery for cleaning rice.—20th December. Six months.

**RAISING WATER.**—To Charles Scidler, of No. 1, Crawford Street, Manchester Square, for a method of drawing water out of mines, wells, pits, and other places.—20th December. Six months.

**LOCOMOTIVE CARRIAGES.**—To Frederick Andrews, Esq., of Stanford Rivers, Essex, for improved construction of carriages and machinery to propel the same.—20th December. Six months.

**POWDER FLASKS, &c.**—To Charles Brandon Baron de Bzenget, of Targat Cottage, Kenilworth Town, for improvements in gun-powder flasks, &c.—20th December. Six months.

**LAMP SHADES.**—To Valentine Bartholomew, of Great Marlborough Street, Westminster, for improved shades for lamps and other lights.—21st December. Two months.

**UMBRELLAS.**—To J. G. Hancock, of Birmingham, for a new elastic and gun-metal, &c.—21st December. Two months.

Correspondents will be replied to in our next.

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# REGISTER

or

## THE ARTS AND SCIENCES.

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**BRUNEL'S PATENT STEAM ENGINE,**

Now in Operation at the Tunnel Works, at ROTHERHITHE.

## BRUNEL'S PATENT STEAM ENGINE.

HAVING lately had the gratification of viewing that stupendous subterraneous work which is now being successfully prosecuted under the bed of the river Thames, at Rotherhithe, an opportunity was thereby afforded us of likewise seeing Mr. Brunel's beautiful steam engine in operation; where it is employed in raising the excavated earth, in the working of pumps, &c.

This steam engine was patented by Mr. Brunel some three or four years ago, but no *description* of it having yet been published, it is with pleasure that we are enabled to lay an account of it before our readers, which, together with the engravings on the other side, may be depended upon for their correctness. This account of the steam engine is intended by us as introductory to a series of papers, detailing the arrangements, and the progress made in forming the tunnel, which we purpose inserting the earliest opportunity.

Fig. 1 is a front elevation, and Fig. 2 a plan or bird's-eye view of the engine, divested of the various gear and appendages employed in communicating its power; in order that it may be clearly and readily understood. The dotted lines in the upper part of Fig. 1 are merely placed by us there, to give a general idea of the manner in which its powers are applied, to effect the operations before mentioned.

*a a a* is a strong triangular frame of cast-iron, containing the two working cylinders, *b b*; these cylinders are inclined towards each other, so as to form an angle of  $102^{\circ}$ , that particular angle having been found by Mr. Brunel to be preferable to all others in effecting a rotatory motion to the crank, by the alternating action of the piston rods. *c c* are the piston rods; *d d* the connecting rods, attached to the revolving crank *e e*, which by its axis communicates motion to whatever machinery may be connected thereto; *f f* are metal rollers, running (we believe) upon elastic steel plates, to give support to the pistons, and thereby equalise their friction in the cylinders.

The steam is received from the boiler into the small cylinders *g g*, and, by the action of pistons therein, the steam is alternately admitted into one of the ends of the working cylinders, *b b*, and a passage opened for its escape at the other. The action of the pistons in the small cylinders, *g g*, is effected by eccentrics, placed upon the axis of the main crank *e*, as may be seen at Fig. 2; these eccentrics give motion to the rods *h h*, which, by the intermediate levers shown, operate upon the pistons in the small cylinders.

The most apparent advantages, resulting from the peculiar construction of this engine, strike us to be;—first, the great strength and stability of the frame work; second, the extreme compactness of the whole machinery, which admirably adapts it to the purpose of navigation; third, the novel and convenient method in which the power is applied directly to the crank, without the usual auxiliary appendages, and in many cases dispensing entirely with the necessity of a fly wheel.

This engine, as represented by Fig. 1, is fixed on the top of a lofty, massive frame work, or tower of wood, built up from the bottom, and in the centre of the great vertical shaft of the tunnel, and is further strengthened by numerous large transverse beams, the extremities of which enter the masonry at the sides of the shaft. On the axis of the crank is fixed a small fly wheel as at *k*, and on the same shaft a toothed pinion *l*, which gives motion to two toothed wheels *m n*; to these wheels are attached the crank-levers which work the pumps; on the shaft of the wheel *n* a drum wheel is fixed, over which a band, *p p*, works; this band passes over another drum wheel (not brought into view); from that another band gives motion to a rigger, at a considerable height above the engine, which rigger carries also another endless band or strap, which is the immediate agent employed for drawing up the excavated earth in strong square receptacles, or small waggons, upon wheels, which, when raised over the platform (as shown by the diagram) are wheeled off to their destination upon an iron railway.\*

#### DAVIDSON'S PATENT PROCESS FOR BLEACHING WAX AND TALLOW.

The ordinary process of bleaching wax consists in first melting it at a low heat, in a cauldron, from whence it is allowed to run out by a pipe at the bottom into a capacious vessel filled with cold water, in which is fitted a large wooden cylinder, that is made to turn round continually on its axis, upon which the melted wax falls. The surface of the cylinder being constantly wet, the wax does not adhere to it, but lays solid and flat, acquiring the form of ribbands. The continual rotation of the cylinder carries off these ribbands as fast as they are formed, and distributes them through the tub. The wax is then put upon large frames covered with linen cloth, which are supported at about 18 inches above the ground in situations exposed to the air, the dew, and the sun. The thickness of the several ribbands thus placed upon the frames, ought not to exceed an inch and a half, and they ought to be removed from time to time in order that they may all be equally exposed to the action of the air. If the weather be favourable the colour will be changed in a few days. It is then to be re-melted, formed into ribbands, and exposed to the air as before. These operations are to be repeated until the wax is rendered

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\* As the quantity of water that collects in the Tunnel is very inconsiderable, it is found that the working with one cylinder only, (that is, half the engine,) is sufficient to raise the whole, as well as all the excavated earth to the surface. If an increase of power should at any time be required, it may instantly be obtained by connecting the opposite piston rod to the crank. Thus the engine may be adapted with facility to whatever circumstances may require of it. The power of the engine is calculated at thirty horses, that is to say, each cylinder operates with the power of fifteen horses.

The pistons now used in this engine, are, we understand, of the expanding metallic kind, those made and patented by Mr. Barton, a preference being given to those above all others by Mr. Brunel, which is, in our opinion, no small recommendation of them.

perfectly white; after which it is to be melted into cakes, or formed into candles.

Of late years the sulphuric acid and other chemical agents have been proposed for shortening the process of bleaching wax, but we are inclined to believe that they have not been successfully carried into practice, as the manufacturers, we are informed, adhere to the old process above described. To what extent *chlorine* has been applied to this purpose, or in what manner we are not informed, but the process employed by Mr. Davidson, of Glasgow, and very recently patented by him, is stated in the specification to be as follows.

The wax or tallow is heated to about the temperature of boiling water in an iron vessel lined with lead, when the oxymuriate of lime, (*chloride* of lime) or the oxymuriate of magnesia, (*chloride* of magnesia) is to be added either in solution with water, or in the dry state; and then intimately mixed and well stirred up with a wooden spatula. When these materials have acted upon each other a sufficient length of time to discharge the colour from the wax or tallow, the lime or magnesia is to be removed by adding dilute sulphuric acid, or some other acid possessing a greater affinity for those earths than chlorine. The whole is then to be boiled, until the earth employed is separated.

For the bleaching of wax the solution of the chloride is to be in the proportion of from 14 to 28 pounds of the salt to 112 pounds of water: and an equal quantity by weight of the solution and of the wax to be employed in the process. The sulphuric acid should be of the specific gravity 1.8485, and be diluted with from 20 to 30 times its weight of water.

For the bleaching of tallow, a solution of chlorine of less strength than the above will suffice, and the sulphuric acid should be more plentifully diluted: but the proportions necessary will vary both in the wax and the tallow, according to the quantity of colouring matter that may be combined with them.

## SELF-ACTING SAFETY VALVES FOR STEAM BOILERS.

[From the Leeds Mercury.]

SIR,

I AM induced, in order to prevent the accidents occasioned by the bursting of steam boilers, which are of such frequent occurrence, and generally so dreadful in their consequences, to send to you the drawing and description of a self-acting safety valve, of my invention, (or rather application to a new purpose; a similar valve having been used as a *clack* for a pump upwards of a hundred years ago.) You will readily perceive, from the several advantages it possesses, that wherever its adoption shall take place, it would scarcely be possible for an accident of this nature to arise. The opening in the lower part of the box, which is fixed on the boiler top, or, if more convenient, on any part of a pipe having a free communi-

cation with it, requires to be of such a size as to allow a free discharge of all the steam the boiler is capable of generating. This opening is covered with a spherical valve, (the outer part of which is brass filled with lead,) of such a size, and consequently weight, as to press with as many pounds per square inch, as it is intended the strength of the steam at a maximum in the boiler should ever be raised to; the obvious effect of which will be (*owing to its being perfectly free from friction*) that, at the very instant the steam arrives at that degree of pressure, the ball will be raised, and a discharge instantly take place, (The projections are merely to prevent the ball at any time from falling off its seat.)

From the nature of its construction; requiring no picking or attention, it can be entirely secured from the interference of careless attendants, and a pipe may be attached to the branch of the box, and continued into the chimney, or any other convenient place of discharge. I should not recommend this valve to be used as a substitute for the ordinary safety valve, (improperly so called) but in all cases in addition, and so loaded as only to be brought into action at a very trifling additional pressure above that to which the other valve is weighted. This valve would be found of the greatest advantage, in preventing the boiling over of the feed pipes of boilers, when the rooms over them are used as drying stoves in print-works, bleach-works, &c.

I ought to state that I have had this description of valve in use for upwards of four years, with the greatest regularity of action.

In the hope that the cause of humanity will in some degree be benefitted by this communication,

Steam-Engine Manufactory,  
Bolton, Lancashire.

I remain, Sir, yours,  
BENJAMIN HICKS.

#### MAYHEW & WHITE'S PATENT SILK-COVERED HATS:

THE patentees (Mr. William White, of Cheapside, and Mr. William Mayhew, of Union Street, Southwark,) propose to obviate the two principal objections to silk-covered hats, consisting in their inflexible rigidity; which frequently hurts the head of the wearer, and

in the premature wearing away of the nap at the edge of the crown; by first making the body of wool as usual, then coating the under side of the brim with beaver, and the edge of the crown with stop wool, so as to render the whole as soft and pliable as an ordinary beaver hat. This done, the hat is to be dyed black, or of the proper colour, then stiffened and blocked by the ordinary process, and afterwards covered with silk.

The fabric usually employed for covering hats is a plush, in which the nap is silk, interwoven in a cotton foundation, the latter being used, we suppose, merely for economy, as our dyers have not yet succeeded in fixing so good a black upon cotton as upon silk. To prevent the brown appearance of the cotton foundation, when the nap becomes worn off in any part, the patentees propose the simple remedy of making the whole covering, foundation as well as nap, entirely of silk. This improvement appears to us to be supplying a real desideratum in silk-hat making, and one calculated to effect a great economy to the wearer.

### ON THE AREAS OF CIRCLES.

*To the Editor.*

SIR,

PERHAPS the following remarks on the Area of Circles may not be unworthy the notice of some of your numerous readers. The area of a circle, of one-eighth of an inch in diameter, is about 012271846303085.

|                               |                    |
|-------------------------------|--------------------|
| This Area, or any other, call | A                  |
| To which add                  | A                  |
| And                           | A x 2              |
| $\frac{1}{8}$ inch diameter   | A x $\square$ of 2 |
|                               | A x 3              |
|                               | A x 2              |
| $\frac{1}{4}$ " " " "         | A x $\square$ of 3 |
|                               | A x 5              |
|                               | A x 2              |
| $\frac{3}{8}$ " " " "         | A x $\square$ of 4 |
|                               | A x 7              |
|                               | A x 2              |
| $\frac{1}{2}$ " " " "         | A x $\square$ of 5 |
|                               | A x 9              |
|                               | A x 2              |
| $\frac{3}{4}$ " " " "         | A x $\square$ of 6 |
|                               | A x 11             |
|                               | A x 2              |
| $\frac{7}{8}$ " " " "         | A x $\square$ of 7 |
|                               | A x 13             |
|                               | A x 2              |
| 1 " " " "                     | A x $\square$ of 8 |
|                               | A x 15             |
|                               | A x 2              |
| $1\frac{1}{8}$ " " " "        | A x $\square$ of 9 |
| and so on continually.        |                    |

The area of a circle, of one inch in diameter,  
 being  $\cdot 78539816339744$  decimal of an inch,—  
 divide it by 144, or  
 what is the same, by  $12 \cdot 065449846949786$   
 and by  $12 \cdot 005454153912482$  will be the decimal  
 of a foot.—This call A, and proceed as above for the area of a  
 circle of one foot in diameter, and others increasing by one inch each.  
 By these notations it may be observed that the primitive circle is  
 preserved in the formation of every succeeding circle, and does away  
 the necessity of coining names for the fluent and constant increasing  
 quantities.

I am your most obedient Servant,



### **London Mechanics' Institution.**

On Wednesday, the 24th instant, Professor Millington concluded a course of nine Lectures on the Philosophy and Application of Mathematics. In this course the professor introduced and explained to his auditory a variety of subjects of great importance to all classes of society; and the members of the Institution evinced, by their crowded attendances, that they felt the importance of the Lecturer's choice of subjects, and, by their approbation at the conclusion of the various demonstrations, that they fully understood and appreciated his reasoning.

After the Lecture the chairman announced that Mr. Cooper would commence a course of Chemical Lectures on Wednesday, the 31st instant, which would be continued each succeeding Wednesday; and that Mr. Hemming would deliver his Second Lecture on the Chemical Properties of the Atmosphere, on Friday next.

### **History of the Steam Engine, Chap. V.**

*Continued from p. 336.*

“When very high temperatures are not to be employed, the kind of boiler just described is found to answer very well; but where the utmost force of the fire is desirable, Mr. Woolf, for a reason which shall be afterwards mentioned, combines the parts in a manner somewhat different, though the same in principle.

“In Fig. 2, A is the main cylinder crossing the smaller cylinders  $a \ a$ , half way between their middles and ends, but not joined to any of them excepting the middle one at the points at which it crosses them. It is put in this place that it may come over that part of the furnace, S S S, Fig. 1, through which the flame first passes, and receives its direct action, which it does over nearly a half of its surface, as may be seen by looking at the vertical section, A S S, Fig. 1. The smaller cylinders have a communication with the main cylinder in the following manner:—Three cylinders, C C C, are placed parallel to



the main cylinder, A, over the part of the furnace by which the flame returns, in such a manner that each of the cylinders, C C C, takes in three of the smaller cylinders, *a a a*, being united to and connected with them. The cylinders, C C C, have a direct communication with the main cylinder, A, by the pipes or tubes, P P P, as may be better seen by the cross vertical section, Fig. 1. The three tubes, C C C, are preferred to one long tube, to prevent any derangement taking place in the furnace or in the tubes, by the expansion or contraction occasioned by changes of temperature, which is more considerable in one tube of the whole length of the furnace than when divided into three portions; and it is for the same reason that the tube A is not made to communicate directly with the smaller tubes, *a a a*, but mediately by means of the tubes marked C and P.—N. B. The two outermost of the tubes marked P, instead of going parallel to the middle tube, P, may be both inclined towards it, so as to join the cylinder A near the middle; or any other direction may be given to them, to prevent derangement by expansion.

“The tubes C and *a* are kept from separating by bolts from the inside of *a* passing through the top of C, where they are secured by nuts screwed on to them, (see Fig. 3); and these parts of C are so contrived, that by taking off any of the nuts a cover may be removed, and a hole presented large enough to admit a man's hand into C to clean it out.

“Fig. 3 is a longitudinal vertical section of the furnace, through the centre, showing the course which the flame and heated air are forced to take. The first three small cylinders are completely surrounded with flame, being directly over the fire: the flame is stopped by the brick-work, W, over the fifth, and forced to pass under it, and then over the sixth, where it again meets with an interruption, which forces it to go under the seventh, and over the eighth; it then turns round the end of the longitudinal wall which divides the furnace, and passes over the eighth smaller cylinder, under the seventh, and so on, alternately, over and under the other tubes, till it reaches the chimney. The wall that divides the furnace may be seen in Fig. 2.

“To secure a free communication between the different parts of the boiler, the three tubes of the middle cylinder, C, are connected with those of the two exterior C's by two pipes, *o o*. The other ends of the tubes, *a a a*, are each fitted with a cover properly secured and bolted, but which can be taken off occasionally to clean out the boiler.

“In working with such boilers the water carried off by evaporation is replaced by water forced in by the usual means; and the steam generated is carried to the place intended by means of tubes connected with the upper part of the cylinder A.

“It may not be improper,” says Mr. Woolf, “to call the attention of those who may hereafter wish to construct such apparatus to one circumstance, namely, that in every case the tubes composing the boiler should be so combined and arranged, and the furnace so constructed, as to make the fire, the flame and heated air, to act around, over, and among the tubes, embracing the largest possible quantity of their surface. It must be obvious to any one that the tubes may be

made of any kind of metal; but I prefer cast-iron as the most convenient. The size of the tubes may be varied: but in every case care should be taken not to make their diameter too great; and it must be remembered that the larger the diameter of any single tube in such a boiler the stronger it must be made in proportion, to enable it to bear the same expansive force as the smaller cylinders. It is not essential, however, to my invention that the tubes should be of different sizes; but I prefer that the upper cylinders, especially the one which I call the main cylinder, should be larger than the lower ones, it being the reservoir, as it were, into which the lower ones send the steam, to be thence conveyed away by the steam pipe or pipes. The following general direction may be given respecting the quantity of water to be kept in a boiler in my construction: it ought always to fill not only the lower tubes but the main cylinder, A, and the cylinder, C, to about half their diameter, that is, as high as the fire is allowed to reach, and in no case ought it to be allowed to get so low as not to keep full the necks or branches which join the smaller cylinders, marked with the letter *a*, to the cylinders A or C; for the fire is only beneficially employed when applied, through the medium of the interposed metal, to water, to convert it into steam: that is, the purpose of my boiler would, in some measure, be defeated, if any of the parts of the tubes exposed to the direct action of the fire should present in their interior a surface of steam instead of water, to receive the transmitted heat which must, more or less, be the case if the lower tubes, and even a part of the upper, be not kept filled with the liquid.

“As to the construction of the furnaces, though that must be obvious from the drawings, it may not be improper here to remark, that they should always be so built as to give a long and waving course to the flame and heated air, or vapour, forcing them the more effectually to strike against the sides of the tubes which compose the boiler, and so to give out a large portion of their heat before they reach the chimney: unless this be attended to, there will be a much greater waste of fuel than necessary; and the heat, communicated to the contents of the boiler, will be less from a given quantity of fuel.

“My invention is not only applicable to all the uses to which the boilers in common use are generally applied, but to all of them with much better effects than the latter, and can, besides, be applied to purposes in which boilers, constructed as they have hitherto been, would be of little or no use. The working of all kinds of steam engines is one important application of my invention; for the steam may be raised, in a boiler constructed in the manner before described, to such a temperature, and consequently to such an expansive force, as to work an engine even without condensing the steam, by simply allowing it to escape into the atmosphere after it has done its office, as proposed by Mr. James Watt; in the specification of his patent, dated January 5, 1769, whence, he says, engines may be worked by the force of steam only, by discharging the steam into the open air. In all cases where it is desirable to heat or boil water, or other fluids and substances, without the direct application of fire to the vessel or vessels containing them, which in such cases become secondary boilers,

the use of my apparatus will produce superior to any obtained by any other means, no more being necessary than to make the vessels, or secondary boiler, containing the water or other fluids, and the substances immersed or dissolved in, or blended or mixed with the water or other fluids, to communicate by means of a tube or tubes, with the prime boiler, constructed in the manner before described. In such cases as in making extracts of every kind for the various purposes of arts and manufactures, and for the simple boiling of water or watery fluids, the steam should go directly into the vessel or secondary boiler, whose contents are to be heated or boiled; and the orifice or orifices of the pipe or pipes through which the steam is conveyed should go to a considerable depth in the fluid, that the steam may be better able to give off its heat, and be condensed before it can reach the surface; and in every such case an allowance should be made for the increase which will be made to the quantity of liquid in the vessel to be heated, by the quantity of steam which will be condensed in the same before the process be ended. The vessels into which the steam is thrown may be either open or close, as the nature of circumstances may require: but where extracts are to be made from vegetable or other matters from which extracts are or may be made, as from hops, bark, drugs, and dry stuffs, for brewing, tanning, dyeing, and other processes, the materials will be much more completely exhausted of all their valuable parts; and in many instances they will be completely dissolved by employing close vessels, which in that case must be made very strong, a thing not difficult to be accomplished, when it is recollected that they may be at a distance from, and consequently out of the power of being deranged by the fire; and that they may be surrounded with, and, as it were, buried in massy stone or brick work, in addition to other and obvious means of securing them. My apparatus so employed becomes, in fact, an improved Papin's digester on a large scale. I do not wish to be understood as claiming the merit of having been the first who applied steam in the manner just described to boil water and other fluids, but merely as pointing out an important use to which my apparatus is applicable, and in which the effect obtained will be much greater than by any other means.

“ Another important use to which my invention can be applied with better effect than the means now in use, is that of distillation on the large scale, and that by either sending the steam directly into and among the contents of the still or alembic, or by enclosing the still in another vessel, and making the steam of a high temperature to circulate in and to occupy the space between the exterior surface of the still and the interior surface of the containing vessel. In either case all danger of burning or singeing the materials operated upon is done away, and a much more pleasant and pure spirit will be obtained than by the methods now in common use. I need not stop here to show the reason why, even in the case of throwing the steam directly into the still, the spirituous part will be the first to rise and pass over into the receiver.

“ I might mention many other useful applications that may be made of my invention; but I shall only state one more, namely, to

the drying of gunpowder, and lessening the danger of explosions in the manufacture of that article. By means of my invention any desired temperature, necessary for that purpose, may be produced where the powder is to be dried, without the necessity of having fire in, or so near the place, as to endanger its safety; for by employing steam only, conveyed through pipes and properly applied and directed without allowing any of it to escape into the room or apartment where the powder is, any competent workman can produce a heat equal to that found necessary for drying gunpowder, or much higher if required. Nor is the lessening of the danger of explosions the only advantage which this way of drying gunpowder holds out, it presents another and an essential one for the goodness of the article, the heat can be completely regulated, so as to prevent, or at least lessen, the partial decomposition of the powder by the sublimation of the sulphur, which is found to take place by the methods at present in use."

We have had frequent opportunities of inspecting this excellent apparatus, and can, therefore, speak with confidence of its utility. One engine of Mr. Woolf's is now used with such a boiler to drive a saw mill, by Mr. Smart, of Lambeth Marsh, and is principally kept going by the saw-dust from the mill. Two safety valves are generally used, the plan of which is ingenious.

A is a part of the main cylinder of one of Mr. Woolf's boilers;  
B B the neck or outlet for the steam surmounted by the steam box



C, which is joined to the neck B B by the flanges A A. The top or cover of the steam box C, marked with the letter D, which is well secured in its place, has a hole through it for the rod of the valve, so contrived as to answer the purpose of a stuffing box to make the rod work up and down steam tight, the stuffing being kept in its place by the usual means, as shewn in the section. By means of a pin or nail *b*, and the two vertical pieces *e e*, the piston rod is made fast to *m*, which is a cover of and joined to the hollow cylinder *n n*. The cover *m* fits steam tight into the collar *o o*, which is made fast to the flanges *a a*. The cylinder *n n* is open at the bottom, having a free communication with the main cylinder A, and has three vertical slits, one of which, S, is shewn in the diagram. The sum of the surfaces of all these slits or openings is equal to the area of the opening of the collar *o o*, in which the cylinders *n n* works. When the steam acquires a sufficient degree of elastic force to raise the valve (that is, the cylinder *n n* with its cover *m*, and the rod R,) and whatever weight it may be loaded with, then the openings S, getting above the steam tight collar *o o*, allows the steam to pass into the steam box C. The quantity of steam that passes is proportioned to the elastic force it has acquired, and the weight with which the valve is loaded; and the rise of the openings S above the collar *o o*, will be in the same proportion. This valve may be loaded in any of the usual methods; but Mr. Woolf prefers the one shewn in the drawing, in which the upper part of the rod R is joined by means of a chain to a quadrant of a circle Q with an arm projecting from it, as represented in the plate, and which carries a weight Z, that may be moved near to or further from the centre of the quadrant, according as the pressure of the valve is wished to be increased or diminished. As the valve rises, the weight moves upwards in the arch *n n*, giving an increased resistance to the further rising of the valve, proportioned to the greater horizontal distance from the centre of Q, which the weight attains by its side in the said arch, the said distance being measured in the line O P passing through the centre of the weight. Thus, if the weight Z press with a force equal to twenty pounds on the square inch of the aperture in O O in its present position, it will, when it rises to the position *i*, press with a force equal to thirty pounds, and at P, with a force equal to forty pounds on the square inch, so that the rod Q Z may be made to serve at the same time as an index to the person who attends the fire, nothing more being necessary for this purpose than to graduate the arch described by the end of the rod Q Z. In the side of the steam box C there is an opening N to allow the steam to pass from it by a pipe or tube to the steam engine, or to any secondary boiler, or for the purpose of conveying and applying it to any other vessel or use to which steam is applicable.

### **Discoveries & Processes in the Useful Arts.**

**EASY MODE OF CUTTING GLASS.**—Mr. Buchner, of Mayence, describes, in the Archives of the Society of Pharmacy, of Northern

Germany, a method of cutting glass, which is as follows:—A thin card, one, two, or three inches broad, is glued to the glass in such a manner, as to cover the line in which the fracture is intended to follow its whole extent. When the card is dry, a line is traced upon it by means of an iron or steel point, taking care to cut it down to the glass. In this groove a thread is then placed, of a line or a line and a half, or two lines diameter, and brought round the vessel. The latter is steadied, and two people laying hold of the thread, move it rapidly backward and forward upon the glass. In less than a minute, and when the thread begins to smoke, the glass cracks. The thickest pieces of glass may be cut in this manner.—*Jameson's Edin. Jour.*

TRANSPARENCY OF THE OCEAN.—Experiments were made during the voyage of the *Coquille*, to ascertain at what depth in the sea an apparatus became invisible, composed of a plank two feet in diameter, painted white and weighted, so that on descending it should always remain horizontal. The results varied very much: at Ofae, in the island of Waigion, on the 13th September, the disc disappeared at the depth of fifty-nine feet; the weather calm and cloudy;—on the 14th, the sky being clear, it disappeared at the depth of 75.3 feet;—at Port Jackson, on the 12th and 13th of February, it was not visible at more than 38.3 feet in a dead calm;—the mean at New Zealand, in April, was 3.28 feet less;—at the isle of Ascension, in January, under favourable circumstances, the extreme limits in eleven experiments were 28 and 36 feet.—*Quarterly Journal of Science.*

ON A SYPHON HYDROMETER, BY MR. MEIKLE.  
This instrument consists of a glass tube, open at both ends, and bent into a kind of double syphon, having four parallel legs; so that the open ends are pointed in the same direction or upwards, as in the annexed figure. The manner of using it is very simple. Let one of the ends be stopped with a finger or cork, and water be poured into the other. The fluid will only rise a small way into the second leg, because of the included air: next stop the other orifice, and open the one first closed; and having poured into the latter the liquid whose specific gravity is to be tried, open the top of the water tube; then the instrument being held upright, the two liquids will arrange themselves so as to press equally on the included air. This pressure will be measured by the difference in the heights of the two columns of either liquid, multiplied by its specific gravity, so that, by dividing the difference of the two columns of water by the difference of those of the other liquid, we obtain the specific gravity of the latter; that of water being unity. The difference between the columns may be measured by applying any scale of small equal parts, or the glass may be attached to a graduated plate furnished with verniers, &c. The longer the columns of liquid employed, the more accurate the process. The expansion of the

glass, or its capillary action, cannot affect the result, nor is it influenced by the expansion of the scale; the only correction required will be to reduce the observations to one temperature.—*Phil. Mag.* lxxviii. 166.

**ALCOHOL DERIVED FROM THE FERMENTATION AND DISTILLATION OF BREAD.**—Dr. Colquhoun has been led, during his investigations into the nature of the panary fermentation, into the belief, that the fermentation is alcoholic; and Mr. Graham states that he has obtained alcohol from bread during the operation of baking. To avoid the use of yeast, which might introduce alcohol, a small quantity of flour was kneaded and allowed to ferment in the usual way to serve as leaven. By means of the leaven a considerable quantity of flour was fermented, and when the fermentation had arrived at the proper point formed into a loaf. The loaf was carefully inclosed in a distillatory apparatus, and subjected for a considerable time to the baking temperature. Upon examining the condensed liquid, the smell and taste of alcohol were quite perceptible; and by repeatedly rectifying it a small quantity of alcohol was obtained, of strength sufficient to burn and to ignite gunpowder by its combustion. The experiment was frequently repeated; and in different bakings the amount of alcohol obtained of the above strength found to vary from 0.3 to 1 per cent. by weight of the flour employed. When the fermented flour was allowed to sour before baking, the amount of alcohol rapidly diminished; and in all cases the disagreeable empyreuma completely disguised the peculiar smell of the alcohol, when in its first diluted state and in vapour.—*Quarterly Journal of Science*, No. xlv.

**FOX'S DELICATE CAPILLARY THERMOMETERS**, are constructed as follows: a bulb is blown at one end of a common thermometer-tube; this is filled in the usual way by applying heat to the bulb, on which the atmosphere forces the mercury into the partial vacuum within the bulb. The tube is then made red-hot in the flame of a blow-pipe, and drawn out into a fine capillary tube, which may be finer or longer, according to the intended delicacy of the instrument. During this operation, the capillary tube contains no mercury, which remains in the lower part of the original thermometer tube, occupying also the whole of the bulb. A small piece of writing paper is then tied round the extremity of the tube, so as to form a cavity, in which a little mercury is poured. The tube thus prepared, is suspended by the upper end with the fingers; and the mercury in the ball being very gradually expanded by heat, in a short time rises up and fills the whole tube, until it comes in contact with the mercury in the upper cavity at the top. Then the instrument being allowed to cool, the mercury passes again into the minute tube, and by cohesion draws an additional portion after it out of the paper cavity, until the whole tube is filled at the common temperature of the air of the room. The bulb should be placed in water of the temperature to which the thermometer is desired to rise, which will cause the superfluous quicksilver to flow out at the top: the capillary

tube may then be hermetically sealed, and fixed on a graduated scale.—*Philosophical Magazine*.

**ON FUSIBLE METAL, AND A REFRIGERATING METALLIC COMBINATION.**—M. Dobereiner says, that the alloy, composed of lead 340 parts, tin 194 parts, and bismuth 466 parts, is infusible at 210° Fah. It may be considered as composed of one atom of an alloy of bismuth and lead, fusible at 323° or 336° Fah., united to one atom of an alloy of bismuth and tin, which fuses at 267° or 278° Fah. When the combination of these alloys takes place it produces cold, of which the following is a striking example. Having mixed 907 parts of lead, 118 of tin, 284 of bismuth, and 1617 of mercury, at the temperature of 63° Fah. the thermometer instantly descended to 14° Fah.—*Annales de Chimie*.

#### LIST OF NEW PATENTS, SEALED.

**WATER-PROOF SHOES, &c.**—To T. Morrison, Esq., of Chelsea, for a process of rendering boots, shoes, and other articles water-proof. Sealed 22nd December. Six months for enrolment.

**HINGES.**—To David Redmund, of Greek Street, Soho, for certain improvements in Hinges. 22nd December. Six months.

**STEAM-ENGINE.**—To Elijah Galloway, of London Road, Engineer, for an improved rotatory steam engine. 20th December. Six months.

**WINDOWS.**—To John Whiting, of Ipswich, for certain improvements in window-glasses, &c. 9th January, 1827. Two months.

**CAPSTANS.**—To James Frazer, of Houndsditch, for an improved method of constructing capstans and windlasses. 11th January. Six months.

**STEAM-ENGINES.**—To James Frazer, of Houndsditch, for an improved boiler for steam-engines. 11th January. Six months.

**PROPELLING.**—To W. M. Hall, late of the United States, but now of Westminster, for mooring and propelling ships, boats, carriages, mills, &c. 15th January. Two months.

**PAVING.**—To Wm. Hobson, Esq., of Stamford Hill, for an improved method of paving streets, &c. 15th January. Two months.

**STEAM-CARRIAGE.**—To James Neville, of New Walk, Shad Thames, Surrey, for a new invented Steam-carriage. 15th January. Six months.

**AXLE-TREES.**—To Wm. Mason, of Oxford Market, for improvements in the construction of mail-coach axle-trees and boxes. 15th January. Two months.

**GAINING POWER.**—To Robert Copeland, of Wilmington Square, for certain improvements upon a patent already obtained by him for gaining power. 16th January. Fifteen months.

#### TO OUR READERS AND CORRESPONDENTS.

A few impressions of our last Number, having been delivered previous to our discovering that a mistake had been made in the order of the pages, those subscribers who may have purchased such copies, can have them exchanged through their regular channel.

The requests of L. S. S. shall be attended to.

The proposition of R. W. — was the subject of a patent about thirty years ago; he will find the specification in the first series of the Repository of Arts, we cannot immediately lay our hand upon the volume.

The offer of "A SUBSCRIBER" we shall be happy to avail ourselves of.

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# REGISTER

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**IMPROVED PATENT STEAM-ENGINE BOILER,**

**BY W. H. JAMES, ESQ. CIVIL ENGINEER,**

Formerly of Vinton Green, near Birmingham, but now of Thavies Inn, Holborn.

## JAMES'S IMPROVED PATENT STEAM ENGINE BOILER.

It is a common opinion among engineers, that so much has already been done towards perfecting the steam engine, that there remains very little more to effect in its improvement; and consequently, that the efforts of the mechanic and the man of science would be more profitably directed towards improving the construction of the boiler, or the means of generating steam, than in attempting any material amelioration of the other parts of the machinery. The desideratum in this department of mechanics appears to us to be the construction of a machine that shall *combine* the following advantages in the most eminent degree, viz.

The power of generating steam of the greatest elastic force, with the most rapidity, at the least cost of fuel:—that shall be the most compact in its form, and of (comparatively) small cost:—that shall be unattended with personal danger from bursting, when exposed to injudicious treatment, or to extraordinary temperatures:—that shall require the smallest quantity of water to work it:—that shall be susceptible of easy repair, and afford the facility of clearing it from incrustations and sediment; and, finally, be that in which coke or charcoal may be advantageously substituted for coal.

Whether Mr. James has succeeded or not in attaining a combination of all these advantages in the greatest degree, we will not affirm; but from the best attention we have been able to afford the subject, we confidently believe he has outstripped all his contemporaries (of which there are not a few of the highest talent and most persevering industry). Our readers will however judge for themselves, after reading our description of his truly elegant and ingenious apparatus.

A series of annular tubes of equal capacity and diameter, are placed side by side, and bolted together, so as to form by their union a long cylindrical boiler; in the centre of which the fire place is situated. The tubes are individually (in their transverse section) of a square figure; they are made of the best wrought iron, of such considerable substance and tenacity, as to sustain a *proving* of 4000lbs. pressure upon the superficial inch: the two flat sides of each ring are turned to smooth level surfaces, so that the junctures may be in all parts perfectly close and uniform. The flat sides of the chambers are connected together by means of brazing, and the whole series are secured by means of long bolts passing through the end plates of the cylinder, where they are screwed up firmly by nuts on the outside. A cylinder of distinct annular tubes being thus formed, a communication from one to the other is opened, by making two perforations in them lengthways of the cylinder; one on the upper side for the free passage of the steam, and one on the lower for the free passage of the water.

When it is desired to construct a boiler of still greater power, the patentee effects it by placing two or more series of such tubes, concentrically, one within the other; the steam and water passages communicating so as to form a single vessel of capacity.

The preceding Figure, 1, represents a longitudinal vertical section of the apparatus, with a double series of annular tubes; and Fig. 2 (annexed), a transverse vertical section of the same; the letters of reference in each Figure, that are alike, designating the same parts. Thus *a a a*, are the square annular tubes, a section of the whole being shewn in Fig. 1; while in Fig. 2, the entire circles of only two of the tubes (one of each series), are brought into view. The upper perforations or steam passages are shewn at *b b*, and the lower perforations or water passages at *c c*. The water is maintained at a certain level (about that exhibited in Fig. 2), by the action of a float in the regulator *d*, which is of a peculiar construction.

### Fig. 2.

The situation of the furnace is obvious in the figures, the bars or grating of which form two inclined planes (as seen by Fig. 2.) The flames and heated air take the direction shewn by the arrows, previous to their being diffused in every part, and the vapour finally escapes downwards by the chimney or flue *e*. This flue is made to slide in and out of its place; the whole furnace is likewise constructed so that it may be easily drawn out of the cylinder. The entire boiler turns upon an axis and rests upon rollers fixed in a circular frame or stand; and every tube is furnished with a few shot, mixed with angular pieces of metal, so that when it is desired to cleanse the boiler from any deposition, it is only necessary to draw out the furnace, the chimney tube, and to unscrew the several pipes, when a few turns with a winch causes the shot to roll, and the angular

pieces to scour the annular chambers clean; the operation being similar to that of the scouring barrel employed at Birmingham for brightening work.

To prevent the loss of caloric by any considerable radiation through the sides of the boiler, the cylindrical casing to it is made double, of sheet iron, with the space between the internal and external coats, closely filled up with a mixture of charcoal and clay, or other materials that are slow conductors of heat.

From the foregoing brief description, together with an inspection of the accompanying engravings, we doubt not that our readers will fully understand the construction of the apparatus, without going into a more lengthened detail; and we think that one very obvious and important advantage which results from the beautiful arrangement of the patentee, can hardly have escaped their attention, in looking at Fig. 2; where it will be seen that the steam which occupies the upper portion of every annular chamber, is exposed to the direct action of the fire, without the intervention of water; the consequence of which necessarily is, that the steam becomes highly elastic, that it may indeed be produced of any required pressure. Thus an augmentation of power is obtained without any increase in the quantity of water, causing also a saving in the fuel; and the pressure of the steam from above being greater than that of the water from beneath, the great defect attending tubular boilers generally, of throwing water into the cylinder along with the steam, is here completely obviated.

Owing to the circumstance of a boiler of this description presenting so extensive a surface to the action of the fire, the steam is generated with great rapidity. In the boiler which we saw at work, containing only a single series or cylinder of tubes, we witnessed perfectly cold water converted into steam, which blew off at the safety valve at a pressure of 150 lbs. upon the inch in the space of 15 minutes from the time the fire was placed in the furnace.

From the convenient manner in which the steam is rarified, a less quantity of water is required, and the size of the boiler may be consequently diminished.

The dimensions of the boiler we saw at work was 20 inches in diameter, and 3ft. 6 inches long; this, together with the steam engine it operated upon, was contained in a frame 5ft. 4 inches long, and 2 feet wide. We saw them in action for a considerable time, and consequently can speak positively to the effect, which amounted to a power exceeding that of 2 horses, making about 80 revolutions per minute.\*

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\* In this engine there are several new contrivances, tending to simplify its parts, to render it more compact, and reduce the friction. The diameter of the working cylinder is only 3½ inches, yet a power exceeding that of 2½ horses has been obtained from it; and Mr. James expects, that with his improved arrangements, he will be able to double its power, without any increase of bulk or fuel. We are not at present at liberty to explain these improvements, but we shall not fail to inform our readers fully upon the subject, as soon as the restrictions upon our pen are removed.

It is a fact too well understood to need explanation, that boilers which are worked by coal fires, (in addition to the nuisance of the dense smoke) destroy the metal of which they are composed with much greater rapidity than those wherein charcoal or coke is used. Mr. James employs the latter generally, which in his apparatus generates steam of the highest elasticity with the rapidity already mentioned; so that the destructive effects of coal fires are obviated.

It having been stated by some persons that the fire acting directly upon the upper parts of the tubes, which are occupied by steam only, would materially injure them. To prove that this was an erroneous notion, Mr. James constructed a small steam boiler, which we have seen, of copper tubes, united them together with *soft* solder, and repeatedly worked it with steam of 30 lbs. pressure upon the inch without its receiving any injury from the action of the fire; this experiment serves to shew that the uniform expansion of the steam in boilers of this construction, carries off the caloric with sufficient rapidity to prevent any injurious effect to the metal.

In our 42nd number, published in June, 1825, we gave some account of Mr. James's patent locomotive coach,\* since that period the attention of the inventor has been chiefly devoted to the construction of a steam boiler adapted to such a vehicle; and the machine which we have now described is the result of his labours. In the accomplishment of this important task he has encountered difficulties which would have checked the progress of minds endued with ordinary talents and energy; but satisfied with the correctness of his theory, his perseverance has been unremitting, and with the assistance of good workmen, he has succeeded in forming a boiler of immense strength, which is perfectly steam tight, and calculated to answer all the purposes for which it was designed.

### **London Mechanics' Institution.**

Mr. COOPER, on Wednesday, the 31st of January, delivered, at this Institution, his introductory Lecture to a Course on METALLURGIC CHEMISTRY, in which he took a comprehensive view of the properties common to all metals, and stated that he should, in his subsequent Lectures, introduce to the notice of the members the properties peculiar to each.—To illustrate the ductility of certain metals Mr. Cooper introduced the following

*Curious Experiment.*—He laid upon an anvil an impression of a seal in sealing wax, covered it with a small piece of lead about a quarter of an inch thick, and then struck it a smart blow with a hammer, which transferred a perfect impression to the lead without injuring the wax, although the latter was no thicker than that usually put upon a letter.

On Friday, the 2nd of February, Mr. GUTTERIDGE delivered a Lecture on A NEW SYSTEM OF STEREOMETRY.—Mr. COOPER's Second

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\* We shall shortly insert a complete description of this invention with engravings.

**Lecture**, which was devoted to the **PROPERTIES, MANUFACTURE, &c. OF COPPER**, was delivered on the 7th of February; at the conclusion of which **ROBERT M'WILLIAM, Esq.** who presided on the occasion, announced to the Members that, on Friday, the 9th, **Mr. STACKHOUSE** would deliver a **Lecture ON BRITISH ANTIQUITIES**; and that on the Friday following, **Mr. PAXTON** would deliver a **Lecture ON ELASTICITY**.

*Election of Officers.*—The Chairman also announced that, on Tuesday, the 6th of March, an election by ballot would take place for a *President*, four *Vice-Presidents*, a *Treasurer*, and fifteen of the *Committee-men*, to serve for one year from that time.



### MACKNAMARA'S PATENT PAVEMENT.

It is perfectly inexplicable to us how it has happened, that, in the present age which is so remarkable for the rapid progress of improvement in every branch of mechanical science, the pavement of the streets of the metropolis should continue to remain in its present ill-conditioned, wretched, and, we may add, dangerous state. Many have been the plans proposed by various individuals for its amelioration, all of them calculated (as far as our observation extended) to

effect it in *some* degree; for, indeed, it seems almost impossible to make *any* alteration, without stumbling, as it were, upon something better.

It is now, we think, four or five years since Mr. Macknamara took out a patent for his excellent pavement, yet so deep-rooted have been the prejudices, or so great has been the influence of the parties interested in the old system, that it is with concern we notice the slow adoption of this valuable improvement.

In our 83rd number we spontaneously noticed this subject in very favourable terms; but it appears from a note sent to us by the patentee, that we fell into some error in our description; anxious to set the matter right with our readers, and to prevent the recurrence of any mistake, we annex an exact copy of the drawings sent to us, to which we shall append such extracts from the specification of the patent as apply to them.

Fig. A represents a plan of a street paved on this system.

B represents a vertical section of the same; the road-way stones, being numbered 1, 2, 3, 4, 5, (as seen in the plan); 6 6, are the gutter stones, and 7 7, those which abut the curb.

C gives a side view of three entire stones, exhibiting the reverse position of the bevelled edges, by which the stones are mutually supported.

D represents the same stones on the reverse side.

By a careful attention to the above figures it will be seen, that each and every individual block or stone, mutually and reciprocally support, and are supported by each other.

This principle will be found to apply throughout; each block or stone, being upheld by two adjoining ones, and in return mutually supporting others that are made to rest upon it. These blocks may be made of any convenient size, as the same principle applies to any sized blocks or stones. The principal object to attend to is to make the bounding lines on the upper surface at right angles, and to keep the faces of the bevelled sides as perfect as the nature of the stone will permit. I shall here observe, that when blocks are used of large dimensions it will be proper to groove them at proper distances, to form a better foothold for horses; and in order to identify my invention, and thereby endeavour to prevent any infringement on this patent, that it consists, solely in working, cutting, or forming the sides of my blocks or stones, so that they shall make alternately obtuse and acute angles with the upper surface of the block or stone, which being done, they may be so arranged or combined, that they will mutually and reciprocally support and preserve each other from the imperfection, so generally found in the usual method of paving.

#### *Observations by the Patentee.*

Exclusive of the advantages above specified, durability may be ranked in the first class, namely, by removing the percussion through the unevenness of the stones;—Secondly, cleanliness from the circumstance of the stones having little or no dirt between them;—

Thirdly, saving in repairing (the Patentee engaging to keep the streets in perfect condition, upon receiving half the annual amount. Fourthly, comfort, arising from having an even surface, by which means the continual jolting will be avoided, and liability of the frequent accidents arising from the same, exclusive of the noise, which will in a very great degree, be avoided by adopting this system.

Arches for sewers, gas and water pipes, are also protected and rendered more permanent, the former by the immoveable surface, which prevents concussion, so detrimental to arches; the latter by the stability of the pavement, as the stones cannot possibly sink, so as to press on and injure the pipes, &c.

This system, as now introduced to the public, is sanctioned by many scientific men, who firmly believe it well calculated to rectify the defects so long and so frequently complained of, a fact corroborated by the specimen in Guildford Street, Brunswick Square (part of the Foundling Estate), where it has been down nearly five years without any reparation.

It is to be observed, that although the specimen alluded to is put down with large stones, that only half (near the houses), is on the system recommended.

### DIAMOND LENSES.

In the last number of the Quarterly Journal of Science of the Royal Institution is an account from the pen of Dr. C. R. Goring, of an interesting and novel class of Microscopes made from Diamonds, the imperishable nature and great magnifying power of which substance is such as to make it very valuable for these instruments; we shall extract this paper for the information of our readers, as it forms a new era in the science.—

“Diamond lenses I conceive to constitute the ultimatum of perfection of single microscopes. My friend, Mr. G. Francis, has calculated the spherical aberration of a plano-convex diamond lens for parallel rays, it amounts to only 0.949 enunciated in terms of the thickness of the diamond, while that of a glass is 1.166; but when it is considered that the magnifying power of the diamond lens is to that of a glass one ground in the same radius as 8 to 3, the said thickness comes to be a very small quantity, where the power and aperture of the glass and diamond are equalized. In fact, the longitudinal aberration of the diamond magnifier, equal in power and aperture to an hemisphere of glass of any focus, is less than one sixth of that of the latter substance, though the disproportion becomes less when smaller angles of aperture are employed. The chromatic aberration of a diamond is known to be about equal to that of a drop of water, of the same radius, which is a mere trifle.”

Mr. Andrew Pritchard, of 18, Picket Street, Strand, made the first diamond lens at my instigation, while under the tuition of Mr. C. Varley. He has just now completed a beautiful double isosceles convex, extremely thin, of the finest water, and free from all flaws:

its magnifying power is abundantly effective for practical purposes.\* Its polish is very high, and flashes on the sight with an almost metallic brilliancy, so that the most careless observer can scarcely fail at once to recognize the invulnerable substance of which it is composed, especially when compared with a glass lens. I little doubt that a diamond lens might be made of  $\frac{1}{16}$ th of an inch focus; indeed, *Mr. P. will undertake to form one of that power!* for such is the enormous refraction of this imperishable and beautiful substance, that it would only require to be ground in a tool requisite to form a lens of glass of the  $\frac{1}{16}$ th of an inch focus.

Mr. Pritchard will be proud to exhibit this curiosity to amateurs of microscopic science, and more especially to those sages who, for certain excellent reasons of their own invention, choose to believe that diamonds cannot be fashioned into spherical curves.

## History of the Steam Engine, Chap. V.

*Continued from p. 349.*

Hornblower's second Rotative Engine differs materially from his former one, it consists of

"A vessel in which the steam operates, made of cast-iron, extremely resembling a globe, flattened at the poles, (see Fig. 1) which shows one of its sides, the other being similar to it. Fig. 3 is a representation of the parts of the machine which move round within the steam vessel, and Fig. 2 represents the interior of Fig. 1, with its lid removed. The pipe A, at Fig. 1, receives the steam from the boiler, to which is connected a valve box, of any usual construction, by which to regulate the admission of steam. At B the eduction pipe is connected, leading from the upper apartment to the condensing apparatus, and turning in such a direction as may be most convenient for the discharging pump to be wrought by means of an arbor, turned by the axle of the machine; on which arbor is a small fly wheel, for the purpose of regulating the inequality of the crank to which the pump rod is attached. D D is a middle part of the steam vessel, furnished with flanges for the purpose of screwing it to E E, and also for receiving the lid; by which means the partition within is secured to its place, in the middle of the machine, and the lid may easily be removed for the purpose of rectifying and repairing the internal structure. G is the square part of one end of the axis of the machine, over which is placed a gland H, divided into parts, in order that it may be put on over the square, and properly embrace the round part of the axis. Within this gland is a stuffing-box for

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\* This diamond lens we had the pleasure of examining, and were highly gratified in viewing some extremely small objects, as the dust or feathers from the Indian butterfly's wing, which were increased in length 240 times, and occupied a surface of 57600 times that of the real object: in optical language the lens is termed  $\frac{1}{16}$ th of an inch focus. Ed.

the purpose of keeping the axle both air and steam tight. In one side of the lower apartment of the steam vessel is a small opening, secured by a lid, for the purpose of cleaning that part of the machine.

Fig. 2 represents the partition within the steam vessel, which may be made either of brass or iron, or of both those metals combined. B B is the lower flange, the upper part being taken away. C C are the two openings or passages for the vanes: these the inventor calls vane-ports, and to obtain a proper idea of their figure, it must be observed that the largest vane-port is formed by the exterior portions of two cones *s*, and at *y*, by a portion of the concave part of a sphere. The extent of this passage throughout must at least be equal to ninety degrees of a circle, and the vanes of a sufficient width, so that two of them may always make their entrance into the vane ports before the other two make their exit. The edge, *c c*, may, therefore, be supposed to descend into the lower apartment one half of their depth, and to rise the other half to meet the eye; but it is not necessary that *s* be so deep all the way as *y*, but converge towards the centre of the machine. This is the ascending vane port; the descending one is included between D D, which are rabbets or seatings for receiving a packing; and *a* represents a rising edge, so as to obtain a depth at least equal to the thickness of the vanes, one half of which edging is below, and the other half above the main axis. These edges receive two metal plates, fixed down with screws on them, for the purpose of confining the packing. The part E is also formed spherically, and is provided with a packing groove, which meets the edge of metal in the middle of the vanes, *k*, Fig. 3. F F is the main axle of the machine, laid in its place without the vanes; one end of which is to perform the work required, and the other is applied to the discharging pump. At D D the packing extends to W W, so as to embrace the nave as well as the descending vane, by which means both the nave and the vanes move steam tight in their revolutions. *v v v v* is that part of the partition which forms a plane at the axis of the globe, and is secured in its place by being seated in a rabbet with the usual jointing materials on the interior margin of the steam vessel. G G are two brasses let down into the partition, and they are raised or depressed by screws as adjustment may require. At *t t* spaces are left for packing round the axle; and the upper brasses which keep down the axle serve also to keep it in its place. At H H are the stuffing boxes mentioned in Fig. 1; they have a division plate of metal in them, so that *s s* being supplied with steam from the valve box, the packing of each side of these vacuities are rendered air-tight. The manner in which the partition and vane ports are constructed, is by rivetting the two parts *v v v v*, together, by means of flanges at I I, first having mounted them on an axis, to correct, by turning, (either by hand or otherwise) the want of smoothness and truth from the casting; and when this is done the main axle is fixed to its place as a guide by which to set up the four vanes, as at Fig. 3, where, by a mere inspection, it is plain how this is performed. The open vane exhibits a frame of metal, which receives a plate on each side: these plates, with the edge of metal, K, cast with the frame, form grooves and vacuities to receive the packing. The nave being hollow receives two iron axles, which are curved in the middle, and there cross each other.

The manner in which they receive the vanes is shown by the figure; also how the packing renders them steam tight on the spherical part of the nave, and that when one of them is moved, its opposite vane on the same axle must also be moved. The main axle is turned true by rivetting the two parts together at the nave, and re-rivetting them after the cross axles are set in their places. All the several parts of the machine being then put in their respective situations, it is very evident that when steam is admitted into the lower apartment the rising vane, which occupies the largest passage, must overpower the other in its descent; and that, if by any means one of the vanes be turned a quarter of a revolution, it must at the same time carry with it the one which is connected on the opposite side of the nave; and this turning is effected by fixing with screws a block of wood, on the partition at K, in the form of a strong bracket. This block will not permit the ascending vane to pass it without being turned on its edge, by which means the one below is turned at the same time, to present its broad surface to the large vane port. It may be necessary to remark that when the machine is to be set at work, the steam is not admitted into the upper apartment of the vessel, to exclude the air, but enters immediately from the valve box to the eduction or discharging pipe, in order to preserve the grease which is made use of to lubricate the internal moveable mechanism of the engine.

We cannot express our opinion on this ingenious machine better than Dr. Gregory, who thus remarks:—

“Is there not some ground for fear that in this contrivance, besides the force lost by the action of the steam upon the edges of the vanes, there will be considerable loss arising from the greater friction attending its operations than those of a common steam engine? In this steam wheel there will be a great quantity of rough surface (that of the stuffing) exposed to frequent contact, and consequent resistance to the moving from the fixed parts; besides, as the stuffed parts are here of great extent with regard to the magnitude of the machinery, and exhibit rapid variations of shape, they may when brought into constant work, be found difficult to keep in order.”\*

Mr. R. Wilcox, of Bristol, obtained a patent in 1804 for lessening the consumption of fuel, by using steam of greater elasticity than common: he proposed in some instances to raise his steam to the pressure of 150 pounds on the square inch.

Mr. Woolf's steam engine is also a most ingenious application of a property which steam possesses: the improvement is founded on a very important discovery which he made respecting the expansibility of steam when increased in temperature beyond the boiling point, or  $212^{\circ}$  of Fahrenheit's thermometer. It had been known for some time (and for this discovery the world is indebted to Mr. Watt,) that steam acting with the expansive force of four pounds the square inch against a safety valve exposed to the atmosphere, is capable of expanding itself to four times the volume it then occupies, and still to be equal

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\* Gregory's Mechanics' Art. Steam Engine.

to the pressure of the atmosphere. Mr. Woolf discovered that, in like manner, steam of the force of five pounds the square inch can expand itself to five times its volume; that masses or quantities of steam of the like expansive force of six, seven, eight, nine, or ten pounds the square inch can expand to six, seven, eight, nine, or ten times their volume, and still be respectively equal to the atmosphere, or capable of producing a sufficient action against the piston of a steam engine to cause the same to rise in the old engine with a counterpoise of Newcomen, or to be carried into the vacuum part of the cylinder in the engines of Messrs. Boulton and Watt; that this ratio is progressive, and nearly (if not entirely) uniform, so that steam of the expansive force of 20, 30, 40, or 50 pounds the square inch of a common safety valve will expand itself to 20, 30, 40, or 50 times its volume; and that, generally, as to all the intermediate or higher degrees of elastic force, the number of times which steam of a given temperature can expand itself is nearly the same as the number of pounds it is able to sustain on a square inch exposed to the common atmospheric pressure; provided always that the space, place, or vessel, in which it is allowed to expand itself, be of the same temperature as that of the steam before it be allowed room to expand.

Respecting the different degrees of temperature required to bring steam to, and maintain it at, different expansive forces above the weight of atmosphere, Mr. Woolf found, by actual experiment, setting out from the boiling point of water, viz.  $212^{\circ}$ , at which degree steam of water is only equal to the pressure of the atmosphere; that in order to give it an increased elastic force equal to five pounds the square inch, the temperature must be raised to above  $227\frac{1}{2}$ , when it will have acquired a power to expand itself to five times its volume, still equal to the atmosphere, and capable of being applied as such in the working of steam engines, according to the invention; and with regard to various other pressures, temperatures, and expansive forces of steam, the same are shown in the following table:—

| Pounds per square inch                                                             |    | Degrees of heat.    |                   | Expansibility.                              |    |                                                                         |
|------------------------------------------------------------------------------------|----|---------------------|-------------------|---------------------------------------------|----|-------------------------------------------------------------------------|
| Steam, of a greater degree of elasticity than the atmosphere, acts with a force of | 5  |                     | 227 $\frac{1}{2}$ | it possesses a power of expanding itself to | 5  | times its volume, and continue equal to the pressure of the atmosphere; |
|                                                                                    | 6  |                     | 230 $\frac{1}{2}$ |                                             | 6  |                                                                         |
|                                                                                    | 7  |                     | 232 $\frac{1}{2}$ |                                             | 7  |                                                                         |
|                                                                                    | 8  |                     | 235 $\frac{1}{2}$ |                                             | 8  |                                                                         |
|                                                                                    | 9  | at a temperature of | 237 $\frac{1}{2}$ |                                             | 9  |                                                                         |
|                                                                                    | 10 |                     | 239 $\frac{1}{2}$ |                                             | 10 |                                                                         |
|                                                                                    | 15 |                     | 250 $\frac{1}{2}$ |                                             | 15 |                                                                         |
|                                                                                    | 20 |                     | 259 $\frac{1}{2}$ |                                             | 20 |                                                                         |
|                                                                                    | 25 |                     | 267               |                                             | 25 |                                                                         |
|                                                                                    | 30 |                     | 273               |                                             | 30 |                                                                         |
|                                                                                    | 35 |                     | 278               |                                             | 35 |                                                                         |
|                                                                                    | 40 |                     | 282               |                                             | 40 |                                                                         |

and so in like manner, by small additions of temperature, an expansive power may be given to steam to enable it to expand to 50, 60,

70, 80, 90, 100, 200, 300, or more times its volume, without any limitation but what is imposed by the frangible nature of every material of which boilers and other parts of steam engines have been or can be made: and prudence dictates that the expansive force should never be carried to the utmost the materials can bear, but rather to be kept considerably within that limit.

Having thus briefly explained the nature of Mr. Woolf's discovery, we shall proceed to give a description of his improvements grounded thereon. Mr. Woolf in his specification states,—“that in describing his invention, he has found it necessary to mention the entire steam engine and its parts, to which, as an invention well known, he neither can nor does assert any exclusive claim: he observes, however, that from the nature of the aforesaid discovery and its application, there can be no difficulty in distinguishing his said improvements from the improved engine of Mr. Watt as to its other common and well-known parts; and then gives the following account of an engine, embracing his new improvements.

“If the engine be constructed originally with the intention of adopting my said improvement, it ought to have two steam vessels of different dimensions, according to the temperature or the expansive force determined to be communicated to the steam made use of in working the engine; for the smaller steam vessel or cylinder must be a measure for the larger. For example: if steam of forty pounds the square inch is fixed on, then the smaller steam vessel should be at least one fortieth part the contents of the larger one; each steam vessel should be furnished with a piston, and the smaller cylinder should have a communication both at its top and bottom (top and bottom employed here as relative terms, for the cylinders merely may be worked in a horizontal, or any other required position, as well as vertical); the small cylinder, I say, should have a communication, both at its top and bottom, with the boiler which supplies the steam, which communications, by means of cocks or valves of any construction adapted to the use, are to be alternately opened and shut during the working of the engine. The top of the small cylinder should have a communication with the bottom of the larger cylinder, and the bottom of the smaller one with the top of the larger, with proper means to open and shut these alternately by cocks, valves, or any other well known contrivance. And both the top and bottom of the larger cylinder or steam vessel should, while the engine is at work, communicate alternately with a condensing vessel, into which a jet of water is admitted to hasten the condensation, or the condensing vessel may be cooled by any other means calculated to produce that effect. Things being thus arranged, when the engine is at work, steam of high temperature is admitted from the boiler to act by its elastic force on one side of the smaller piston, while the steam which had last moved it has a communication with the larger steam vessel or cylinder, where it follows the larger piston, now moving towards that end of its cylinder which is open to the condensing vessel. Let both pistons end their stroke at one time, and let us now suppose them both at the top of their respective cylinders.

ready to descend; then the steam of forty pounds the square inch entering above the smaller piston, will carry it downwards, while the steam below it, instead of being allowed to escape into the atmosphere or applied to any other purpose, will pass into the larger cylinder above its piston, which will take its downward stroke at the same time that the piston of the smaller cylinder is doing the same thing; and while this goes on, the steam which last filled the larger cylinder, in the upward stroke of the engine, will be passing into the condenser during the downward stroke. When the pistons in the smaller and larger cylinder have thus been made to descend to the bottom of their respective cylinders, then the steam from the boiler is to be shut off from the top and admitted to the bottom of the smaller cylinder, and the communication between the bottom of the smaller and the top of the larger cylinder is also to be cut off, and the communication between the top of the smaller and bottom of the larger cylinder; the steam, which in the downward stroke of the engine filled the larger cylinder, being now opened to the condenser, and the communication between the bottom of the larger and the condenser shut off; and so on alternately, admitting the steam to the different sides of the smaller piston, while the steam last admitted into the smaller cylinder, passes alternately to the different sides of the larger piston in the larger cylinder, the top and bottom of which are made to communicate alternately with the condenser.

“In an engine working with the improvements which have been just described, while the steam is admitted to one side of the piston in the smaller cylinder, the steam on the other side has room made for its admission into the larger cylinder, on one side of its piston, by the condensation taking place on the other side of the large piston, which is open to the condenser; and that waste of steam which takes place in engines, worked only by the expansive force of steam, from steam passing the piston in the smaller cylinder, is received into the larger.

“In such an engine, where it may be more convenient for any particular purpose, the arrangement may be altered, and the top of the smaller made to communicate with the top of the larger, and the bottom of the smaller with the bottom of the larger cylinder; in which case the only difference will be, that when the piston in the smaller cylinder descends, that in the larger will ascend, which, for some particular purposes may be more convenient than the arrangement before described.”\*

*(To be continued.)*

## Discoveries & Processes in the Useful Arts.

**BOTANICAL CURIOSITY.**—A leaf of the tallipot tree has lately been brought to this country from Ceylon, of which island it is a native. The leaf is in a good state of preservation, it measures fully

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\* Philosophical Magazine.

11 feet in height, 16½ feet at its widest spread, and from 38 to 40 feet in circumference. If expanded as a canopy, it is sufficient to protect a dinner party of six from the rays of the sun, and in Ceylon it is carried about by the natives for that purpose.—*Asiatic Journal*.

**METHOD OF RESTORING WINE.**—A method of restoring wine that has been turned, has been in practice for some years in France. It consists in adding from half an ounce to two ounces of tartaric acid to a hectolitre of wine, according to its state of decomposition. The tartaric acid reproduces the tartar, disengages the carbonic acid, and consequently destroys the alkaline character given to the wine by the sub-carbonates. From the impossibility of determining the exact quantity for every case, this method is not always successful.

**VARIATION OF THE PRIMITIVE FORMS OF SALTS.**—Dr. Wollner, a German chemist, has found that one and the same salt assumes different fundamental or *primitive* forms, according to the nature of the liquor in which the crystals are found. As an instance of this fact, if a small portion of solution of sulphate of iron is poured into a solution of alum, and the whole is allowed to crystallize, the sulphate of iron assumes the octahedral form of the alum, although these octahedral crystals contain scarcely a trace of alum.—*Edin. New Philosophical Journal*.

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#### TO OUR READERS AND CORRESPONDENTS.

[Our Readers and Subscribers are respectfully informed that the present Volume of this Work will be extended to three or four more numbers, with the view of completing the "*History of the Steam Engine*" therein. The succeeding volume will be the commencement of a new and much-improved series; the price will not, however, be increased.]

Received as we were going to press, A CONSTANT READER AND ADMIRER; —JAMES B——T——. Mr. BARLOW's Papers, which appear too much of the nature of an advertisement for our Work.

**WATER-WHEEL QUESTION.**—We have received an answer to this from AN OPERATIVE MECHANIC, which want of room obliges us to omit until our next. The enquirer may, however, see the communication at No. 88, Cheapside; previously, if he wishes it.

*To the Trade.*—The next and succeeding Numbers of this Work will be published by L. HERBERT, at No. 14, Paternoster Row.

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# REGISTER

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BROADBENT'S PATENT  
METHOD OF PREPARING AND PURIFYING INFLAMMABLE GASES,  
BY THE ADMIXTURE OF ATMOSPHERIC AIR.

## PATENT GRANTED TO SIMEON BROADMEADOW,

Of Abergavenny, Civil Engineer,

FOR A NEW METHOD OF PREPARING AND PURIFYING INFLAMMABLE GASES, BY THE ADMIXTURE OF ATMOSPHERIC AIR.

IN conformity with the request of an intelligent correspondent, and no less so with our own wishes to render this work a depository of every improvement in that peculiarly interesting *manufacture* (as it is termed) of inflammable gas, we now insert a description of the above-mentioned invention. We do not know whether the process recommended by the patentee answers the purpose, but as it is one of great economy, it ought to be known and be fairly tried. Those persons, however, who are not well acquainted with the chemistry of the subject, must be upon their guard against explosion, which too great an admixture of atmospheric air with the gas would occasion.

In the diagram attached to the specification of this patent, the arrangements are not so judicious as those in the preceding engraving, for the original of which we are indebted to the politeness of Mr. Henry Adcock, whose observations on the subject we shall avail ourselves of in its description.

It consists,—first, in substituting brick ovens for iron retorts; secondly, in exhausting the ovens of the gas, as fast as it is generated by the application of an exhausting cylinder, constructed somewhat similar to the blast cylinder used in iron works, or by any other means of exhaustion; and thirdly, in purifying the gas so generated, either wholly or partially, by admitting into the gasometer a certain portion of atmospheric air.

*a* is an oven; the size and number of them need not be restricted. *b*, the oven door; *d*, door of the fire-grate; *e*, a pipe, through which the gas is conveyed from the oven to the condenser *f*, into which a small hand pump, *g*, is inserted, to draw off the coal-tar; *h*, a pipe, through which the gas passes from the condenser into the top of the exhausting cylinder *i*. The piston of this exhausting cylinder receives its motion from a small steam engine, or other mechanical power. The engine is supplied with steam from a boiler fixed in the flue, and heated by the waste fire of the furnace. *k k*, two pipes; one leading from the top, the other from the bottom of the exhausting cylinder, to the purifier *l*; *m*, an outlet pipe, to convey the gas from the purifier, into the gasometer. And *n*, is a pipe branching from the pipe *h*, to convey the gas, at the alternate vibration of the beam, into the lower part of the same cylinder.

As the term “steam engine” is apt to convey to the mind an idea of expensive apparatus, it may not be amiss to state, that the engine required for this purpose is so small, that were not steam the first mover, it would comparatively speaking of it with an engine of even one-horse power be ill-deserving of the appellation.

In the erection of works, on the ordinary plan, one of the principal items of charge, is that for iron retorts, together with the hydraulic main, and other necessary connections; and in conducting works on the same principle, an enormous expense is annually incurred, by the

oxidizing or burning away of the retorts. Indeed, the oxidation of the retorts is so rapid, that, however the time of their duration may vary, from a difference in the quality of iron, or mode of constructing the furnace, they cannot withstand, on an average, more than eight or nine months' exposure to the fire.

In the patent process no retorts are used; but ovens constructed of brick, &c. Consequently, the cost of first erection, and the subsequent annual charge for wear and tear is greatly diminished. The ovens, it must be confessed, are also subject to wear and tear; but the expenses thus incurred are, comparatively speaking, too trivial to deserve mention. For, at works erected on this principle at Abergavenny, an oven which has for the last two years been in constant use, is apparently none the worse for wear and tear; and a less sum than twenty shillings each, per annum, is found adequate to keep them in repair.

As each of these ovens contain a charge equal to about six full-sized iron retorts, and requires to be charged but once in twenty-four hours, there is not only a saving in the cost of first erection, and annually in the expenditure for wear and tear, but also in the daily labour consequent upon the old process; in which much of time, as well as labour, is usually expended in the drawing of the charges, and in re-charging.

The next improvement, and which has been already stated, as one of the principal features in Mr. Broadmeadow's invention is, that of his patent application of an exhausting cylinder, or other apparatus, to exhaust the gas from the condenser, thereby causing a partial vacuum, and enabling the gas to flow from the ovens into the condenser as fast as it is generated. By means of this exhausting cylinder, a portion of atmospheric air, equal to about one-eighth part of the entire quantity of gas, is admitted into the gasometer, when the oxygen of the atmosphere mixing with the sulphuretted hydrogen precipitates the sulphur, and gives to the lighted gas a greater degree of brilliancy. This mode of purifying is said to be so efficient, that when the coal used is of good quality, no other purifying process is required, as the admission of too great a portion of atmospheric air would prove injurious, the requisite speed at which the exhauster should be worked, is shown by a water-gauge.

The advantages to be derived from the adoption of this patent process are considered by the patentee to be as follow:—first, the cost of erecting works on this principle, is calculated at one-third less than on any other; second, the annual outgoing for the wear and tear of retorts is entirely obviated; third, the gas is improved and much more effectually purified; fourthly, the coke from the coal being carbonized in larger quantities, is of a superior quality.

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### DUNN'S PATENT SCREW PRESS.

THIS is a convenient modification of the Screw Press, by Mr. Daniel Dunn, (the essence of coffee manufacturer, in King's Row,

Pentonville,) for the pressing of paper, books, tobacco, cloth, &c. and for expressing of oil, extracts, tinctures, &c.

Instead of the simple lever consisting of a long straight bar, which requires so large a space to move it in, the patentee uses a compound lever, (much like those employed in the ordinary printing press,) by which means the same power is obtained in a much more compact apparatus.

Fig. 1 represents an elevation of the complete press, and Fig. 2 a plan of the improved part of the machine; the like letters in each figure denoting similar parts.

*a* is the bed of the press, of massive oak; *b b* the cheeks; or side framing; *c* the head; *d* the nut, fixed into the head, through which the screw *e* is turned; *f* is the platten; *g* the goods, together with the press boards or metal plates between them. Thus far the press is like others; but instead of having a large screw-head, with apertures for the insertion of a long lever bar, that part of the screw is squared, and on it is fixed a circular metallic plate or wheel, *h*, with a double row of ratchet teeth; one of the rows of teeth project horizontally from the periphery, the other vertically; as will be understood upon examining both figures. *i* is the handle of the compound lever, which being formed into a circular eye at the farthest extremity, is thereby fixed upon, and traverses up and down the fulcrum *k*, which is an upright bar firmly bolted to one of the cheeks of the press. To alter the power according to circumstances, the curved end of the handle *i* is perforated with several holes to receive a key or bolt, which fastens the other portion, *l*, of the compound lever to it, (best seen in Fig. 2); the extremity of *l* is hooked or notched, so as to take hold of the teeth of the ratchet wheel, and it has a plate screwed on to it at *o*, to prevent it from falling off. To support the compound lever at the required elevation, a stout pin is passed into a hole, of which there are series made for the purpose, in the side check.

In operating with this press, the goods are laid upon the bottom board in the usual manner, the platten  $f$  is then brought down by turning the ratchet wheel round by hand. The pressure is then given by pulling back the handle  $i$  in the direction, and to the position, shown by dotted lines in Fig. 2; by repeatedly moving the handle in this way, the ratchet wheel is drawn round by the lever, which causes the screw to descend, and to force the platten against the goods; during this operation it will occasionally be necessary to let the lever descend upon the fulcrum, by taking out the supporting pin and putting it into the next hole beneath.

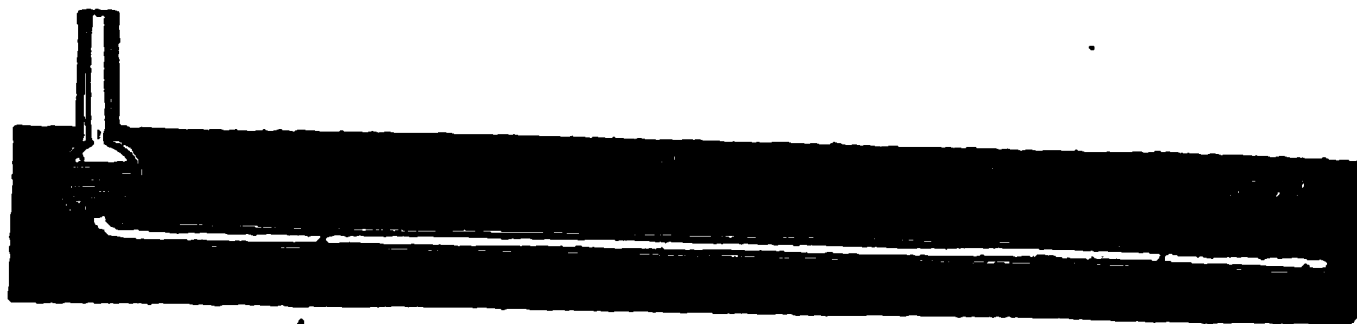
When it is required to unscrew the press, the hooked end of the lever  $l$  is placed in contact with the circle of teeth on the upper surface of the ratchet wheel; the lever being then pulled the reverse way, the screw is raised and the pressure taken off.

### DESCRIPTION OF A PRESSURE GUAGE,

INVENTED BY MR. HENRY RUSSELL, OF THE CITY ROAD,

[Abbreviated from the Philosophical Magazine, N<sup>o</sup>. 63]

THE guage consists of a glass tube sealed at one end, with a ball blown very near the other, leaving only as much beyond the ball as may be necessary for connecting it with the pipe leading from the vessel containing the condensed steam, gas, or other elastic vapour. This ball, when the tube is filled with air, and subject only to atmospheric pressure, should be about three quarters full of mercury, and the whole capacity need not exceed that of the tube more than as two to one. That the divisions in the scale may be in geometrical progression, the tube is placed in a horizontal position: this renders the instrument altogether so simple in appearance, that persons totally unacquainted with instruments of this description, may at once be brought to understand its nature, and be able to affirm with confidence the degree of pressure to which it is subject.



To determine the degree of pressure at any given point, ascertain the distance of that point from the sealed end of the tube, and by that measure divide the length contained between the sealed end and the bulb; the quotient will be the number of atmospheres. Thus in general terms, where  $T$  represents the whole tube,  $P$  the part into which the column of air is compressed, and  $A$  the number of atmospheres; we have  $\frac{T}{P} = A$ . Thus, suppose the tube 8 feet long, and the column of air compressed into half that length, then we have  $\frac{8}{4} = 2$  atmospheres. If this column be again compressed into half its volume, it will be represented by  $\frac{8}{2} = 4$  atmospheres;—if again com-

pressed into half its volume, we have  $\frac{1}{2} = 8$  atmospheres;—if again, (8 feet = 96 inches)  $\frac{2}{3} = 16$  atmospheres;—and lastly,  $\frac{3}{4} = 32$  atmospheres, which is about the density at which the Portable Gas Company engage to supply their friends. In the annexed figure is represented my own gauge complete, (except that there are given only the geometrical divisions,) with the mercury chamber blown in the tube itself; so that in this plan we have no joints whatever to make in the instrument; and being placed in a horizontal position at a convenient distance from the floor, all parts of the scale may be examined with equal facility.

For the internal diameter of the tube perhaps one-sixteenth of an inch will be found preferable.

The following numbers represent, in inches and decimal parts, the spaces between each division representing a number of atmospheres, and the top of the scale.

| Atmospheres. | Inches. | Atmospheres. | Inches. |
|--------------|---------|--------------|---------|
| 1 .....      | 96,000  | 17 .....     | 5,647   |
| 2 .....      | 48,000  | 18 .....     | 5,333   |
| 3 .....      | 32,000  | 19 .....     | 5,052   |
| 4 .....      | 24,000  | 20 .....     | 4,800   |
| 5 .....      | 19,200  | 21 .....     | 4,571   |
| 6 .....      | 16,000  | 22 .....     | 4,368   |
| 7 .....      | 13,714  | 23 .....     | 4,173   |
| 8 .....      | 12,000  | 24 .....     | 4,000   |
| 9 .....      | 10,666  | 25 .....     | 3,840   |
| 10 .....     | 9,600   | 26 .....     | 3,692   |
| 11 .....     | 8,727   | 27 .....     | 3,555   |
| 12 .....     | 8,000   | 28 .....     | 3,428   |
| 13 .....     | 7,384   | 29 .....     | 3,310   |
| 14 .....     | 6,857   | 30 .....     | 3,200   |
| 15 .....     | 6,400   | 31 .....     | 3,096   |
| 16 .....     | 6,000   | 32 .....     | 3,000   |

#### AN ANSWER TO THE INQUIRY RESPECTING THE CONSTRUCTION OF A WATER WHEEL,

Inserted in our 90th Number.

SIR,—In answer to a country subscriber ("No Mechanic") how to make the most of an 8-feet fall of water, he says he has been recommended, on the one hand, to have a wheel of 18 feet diameter, and on the other hand, to have one of 10 feet diameter, only wider: Now, I think the 10 feet wheel the best; but as the writer has given no data to go by, we must assume one to answer the inquiry. Say, for instance, that 8 cubic feet of water descends per second, and that the 18 feet wheel was erected, the water would enter about 2 feet below the centre, and, as soon as entered, would begin to waste again, (unless made wide as hereafter recommended in the case of the small one); and supposing it to be a close race, it can only act after it is out of the bucket, therefore a bucket wheel, of the dimen-

sions stated, would be preposterous. Now, in the 10 feet wheel, the water would enter about 2 feet from the top, and if the buckets are made after the way I would recommend, I am sure they would be more effective. Supposing the water to be 8 cubic feet per second, (for we have nothing else to go by but supposition) and that three buckets pass per second, then the 8 feet divided by 3 will give the contents of each bucket; now if each bucket was only made to contain the quantity of water continually running, as soon as it descended beyond the centre it would begin to run out, and the water would have but an instantaneous effect; but if the wheel be made wide enough to contain three times the quantity, it is plain the water would be retained as long as it would be in any degree effective, and the large wheel would not do more, unless made equally as wide.

There is a back-shot, or pitch-back water wheel, newly erected where I live, and the wheel is well made, but it has the fault I stated, that the capacity of the bucket is about equal to the stream; the consequence is, that the water is half wasted: now, were that wheel double its present width, (for I would recommend large buckets) the power would be at least one third more. The gentleman says it is to drive small machinery with great velocity; now the steadiest wheel would be the small one, for, acting only by gravity, and going slow, it would be a constant weight, and being regulated to the machinery would scarcely want a governor, unless working by night. As to the horse power of the wheel, assuming the same data, it is about seven horses.

### AN OPERATIVE MECHANIC.

#### **London Mechanics' Institution.**

MR. COOPER'S Lectures on Metallurgic Chemistry continue to be delivered on the Wednesday evenings, and to excite much interest amongst the members. On the 16th and 23rd of February, MR. PRESTON delivered Lectures on the Elasticity of Bodies. At the conclusion of the Lecture on Wednesday last, it was announced to the members that MR. HEMMING would deliver a Lecture on Combustion, on Friday, the 2nd of March;—that a meeting of the Members for the purpose of electing Officers for the ensuing year, would take place on the 6th of March;—and that a Quarterly General Meeting would be held on Wednesday, the 7th, to receive the Committee's Report of the Proceedings of the Institution.

#### **History of the Steam Engine, Chap. V.**

*Continued from p. 367.*

Mr. Woolf in his patent of 1805, proposed to use oil or fat to surround his cylinders in place of steam, previously used to prevent the waste of caloric. He also proposed to surround his piston with

mercury, or employing upon it such a column of it as might be equal to the pressure of the steam. But Mr. Woolf possesses much greater claim to notice by his invention of a most excellent method of tightening the packing of pistons. It is well known that the piston of a steam engine by continued working becomes easy, and by allowing steam to escape past it occasions a considerable waste; so that it is necessary in the common plan to take off the top of the cylinder in order to get at the screws or supply the piston with fresh packing.

Mr. Woolf obviates this difficult and laborious operation by a method of tightening the screws without in the least disturbing the cover of the cylinder, which he thus effects.

He fastens each of these screws into a small wheel (*c c c c c*, *Fig. 2*) which are all connected with each other by means of a central wheel *d d*, which works loose upon the piston rod in such a manner, that if one of the small wheels be turned, it turns the central wheel, and the latter turns the other four. The one that is to be first turned is furnished with a projecting square head, which rises up into a recess in the cover of the cylinder. This recess is surmounted by a cap or bonnet, which being easily taken off, and as easily put again in its place, there is little difficulty in screwing down the packing at any time. The parts are so clearly expressed in the drawing that no further description is necessary to make any person comprehend it.

The other method is similar in principle, but a little different in construction. Instead of having several screws all worked down by one motion, there is in this but one screw, and that one is a part of the piston-rod: on this is placed a wheel of a convenient diameter, the centre of which is furnished with a female screw. This wheel is turned round, *i. e.* screwed down by means of the pinion *o*, *Fig. 1*, which is furnished with a square projecting head rising into a recess of the kind already described. The ring is prevented from turning with the wheel by means of two steady pins.

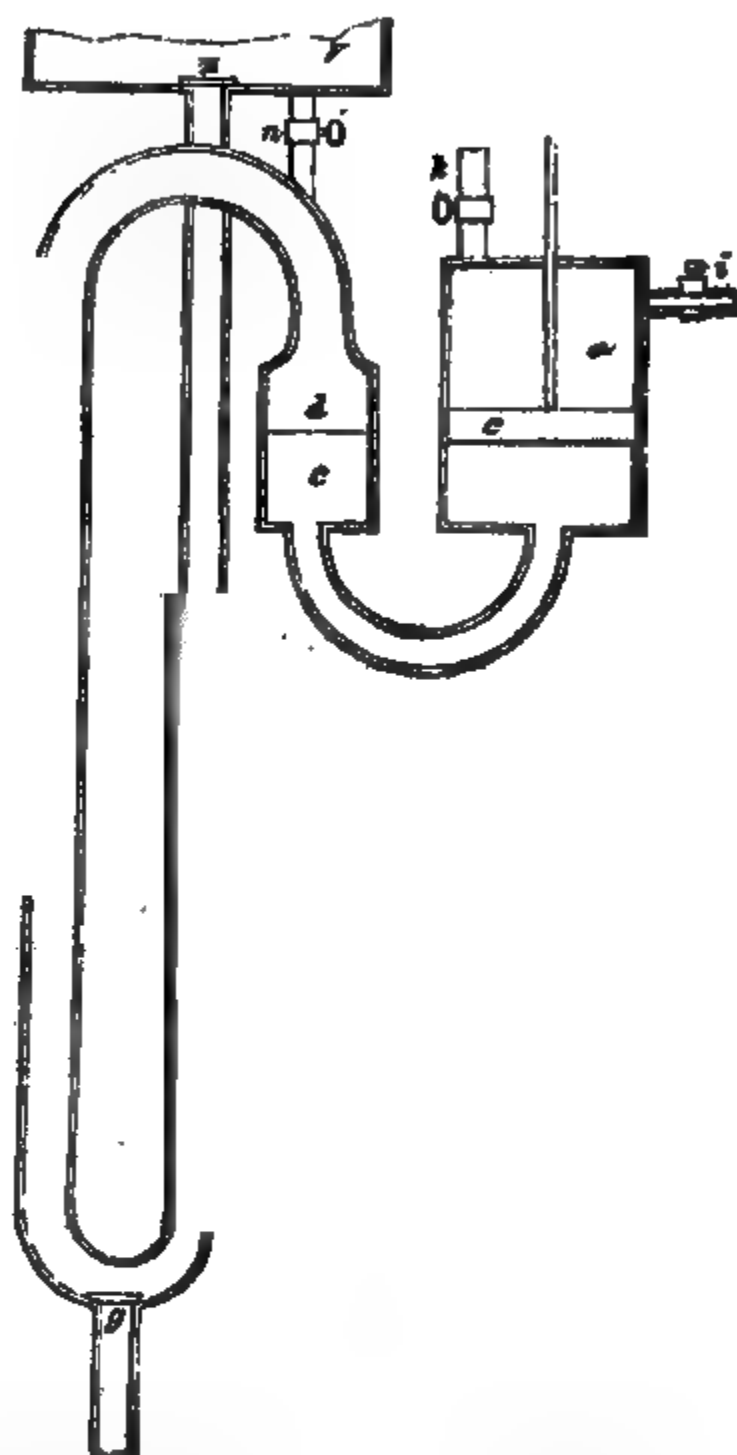
Mr. James Boaz, of Glasgow, obtained a patent in 1805, for a machine for raising water on a plan somewhat similar to Savery's.

*a* is the steam cylinder; *i* the pipe from the boiler, having a stop cock; *k* a waste steam cock; *c* a floating piston attached to a piston rod. *E* a pipe which generally contains hot water; *f* water pipe, having a valve at *g* immersed in the well, and delivering the water into the reservoir *v*, through a valve *s*. The air which accumulates in the receiver escapes at *n*; *v* the raised water cistern; *d* rarifying or exhausting vessel.

The whole being filled with mercury and water, shut the air valve *s*, and open *i*, the steam from the boiler will rush into the receiver, and after heating the water, it presses on its surface, forcing the mercury up into the exhausting vessel *d*. The water above *c*, and in the pipes *E f*, will be forced up into the cistern *v*, in a quantity nearly equal to the space occupied by the steam in the receiver. When the piston has been depressed as far as is necessary for its stroke, the self-acting mechanism attached to its rod, shuts *i*, and opens *k*; and the mercury being now at liberty to act by its gravity, descends from the exhausting pipe, and raises the piston to its first position; and the steam which pressed it downwards being now allowed to flow into the atmosphere, the fall of the mercury from *d* into *a*, leaves a vacuum in *d*, into which the water in the well is pressed by the atmosphere, and again fills it. The valve at *g*, prevents its return to the well in the operation of forcing; and the valve *s* prevents its fall from the cistern when the vacuum is made in *d*.\*

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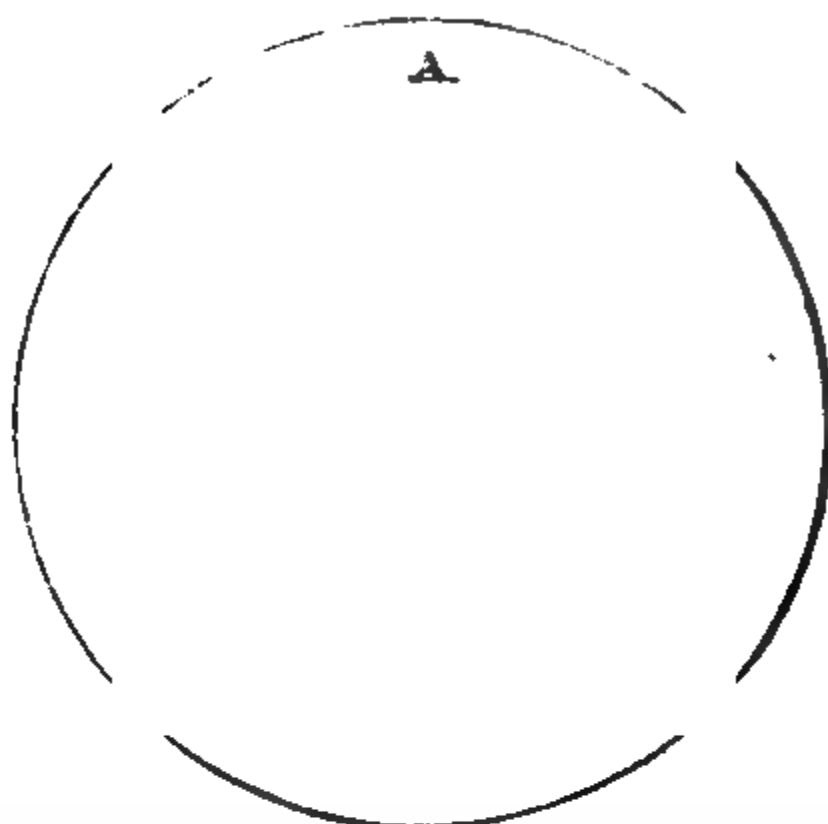
\* Repertory of the Arts.



In the year 1805 Mr. John Trotter, of London, obtained a patent for a Rotative Engine, which may be thus illustrated.

A, a circular piece called the outer barrel. B the inner barrel. C, a circular piece called the eccentric. D, a piece called the sweep, which shuts completely across the space between the inner and outer barrels, so as to intercept the communication in that part. There are caps or covers at each end of the pieces, which close the space between the two barrels, and serve, by grooves or other well-known fittings, to keep the other parts in their respective places.

The situations and motions of the parts herein enumerated are as follow:—1st, the barrels are concentric; 2ndly, the sweep is capable



of moving or revolving (either by absolute or rotative motion) through the space between the barrels: it may be either separate from the barrels, or it may be fixed to either or both of them, and in the last mentioned case, the barrel or barrels to which the sweep shall or may be so fixed, will necessarily move along with it. The sweep is so well fitted or fixed that no fluid shall pass through the places of its opposition or junction with the barrels or caps, or as that the quantity suffered to pass shall be inconsiderable. 3rdly, the eccentric is of such a diameter and so wrought, that its concave and convex surfaces shall touch the inner and outer barrels, and that the places of contact shall not admit any fluid to pass between the eccentric and each barrel severally, or at least, that the quantity which may so pass shall be inconsiderable. The eccentric is capable of rotation in its own plane or periphery, but not otherwise with relation to the caps; and it has a long perforation through which the sweep is put, consequently the sweep and the eccentric will always move together.

It may be pointed out, as distinguishing characters of this engine, that, whenever the sweep is moved, the space which is comprehended between the barrels and the eccentric, and the posterior or hinder surface of the sweep will be continually enlarged, and that the space which is in like manner comprehended between the barrels and the eccentric, and the anterior or fore surface of the sweep, will be continually diminished, excepting that, soon after the sweep has passed at or near the places of contact between the eccentric and the outer barrels, the posterior space will be suddenly diminished by the separation of all that portion which was comprehended between the eccentric or outer barrel, in consequence of the place of contact having come to be behind the sweep. And also, that soon after the sweep has passed at or near the place of contact between the eccentric

and the inner barrel, the posterior space will be suddenly diminished by the separation of all that portion thereof which was comprehended between the eccentric and the inner barrel, in consequence of the place of contact having come to be behind the sweep; and the said portions so separated will then respectively become portions of the anterior spaces, in consequence of the interval or distance which will at the same time be formed between the eccentric and the barrel immediately before the sweep. Whence it is manifest, that if any fluid be forced by gravity, elasticity, or otherwise, through one or more apertures from without into the space on one side of the sweep, that pressure will carry the sweep forward and the eccentric along with it, together with such barrel or barrels, as by the construction shall or may be fixed to the sweep; and, moreover, if there be any one or more other apertures communicating from the opposite side of the sweep, in order to allow the said fluid to escape, or be carried off or condensed, or otherwise disposed of, all such portions of the said fluid as, by the change of situation of the sweep hereinbefore described, shall be separated from occupying part of the space behind the sweep, and shall come to occupy part of the space before the same, will, in fact, so escape or be carried off, or condensed, or disposed of, and the rotatory motion of the engine will be kept up, and may be applied as a first mover to other works, so long as a due supply of the said fluid shall be afforded.

It is manifest, that in case the rotatory motion of the said engine be produced by any force not applied to its internal parts in the manner hereinbefore described, and any fluid be admitted to communicate with the posterior space within the same, the said fluid so admitted will flow into or be absorbed in the said space, which becomes continually enlarged, and will afterwards be transferred to, and drawn out of, the anterior space which becomes continually diminished as aforesaid: and that, in this application, the said engine may be used to raise or give motion to fluids in any direction whatever.\*

This rotative engine possesses originality and ingenuity which cannot be said of many we have enumerated. Our readers will perceive that the reasons which we have given for the failure of many of such like attempts may be applied to this apparatus with no less truth. Friction has been generally the cause of their failure, and here that friction appears more than double of almost all we have yet noticed. For to the friction of the sweep we must add that of the ends of the concentric and eccentric cylinders, which are packed at their peripheries, besides the friction of the points where they are in contact with each other. If machines of this nature, when encumbered with only one inner cylinder, have been inferior in effect to the reciprocating engines, it cannot require much discernment to see that, in this instance, where two such cylinders are used, the power must be trifling indeed. Further, it may be added, that all the parts would be liable to wear out of the form in which they were

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\* Specification of Patent.

first constructed, so that no packing could preserve them steam-tight. This we apprehend would take place in a short time, at the sides of the cavity formed in the eccentric cylinder, for allowing the sweep to slide through it.

We consider the machine we are about to describe, invented by Mr. Andrew Flint (and patented about the same time), as liable to the objections we have just mentioned. The difficulty of packing indeed (all others out of the question), appear to be an insuperable barrier to its application.

Fig. 1 is a horizontal section through the body of the engine. Fig. 2, which is a vertical section of the same, in the line *uv* of Fig. 1; the same in each figure being marked with the same letter. C is the outer cylinder of cast iron, or other proper metal; D the bottom plate of the same. E the top plate, firmly fastened down by screws passing through the projecting flanges at *ff*. G is the inner cylinder, hollow, and divided by a partition at *A*. The two cylinders, C G, must be turned very true, and placed exactly



concentrically. *A B* is the hollow central shaft, cast in one piece with the cylinder *G*, and forming an axis to it, turning in the stuffing boxes *l l*. *K* and *L* are two valves, each consisting of a top and a bottom plate *m m* (see Fig. 4), connected by a portion of a solid cylinder *n*. The plates *m* are sunk into the plates *D* and *E*, so as to lie flush with their inner surfaces; and the connecting piece *n* lies in and fills the cavity prepared for its reception in the outer cylinder *C*, at *o*, and thus completes the inner surface of the same.

*P* is the steam float, firmly attached to the cylinder *G*, and revolving with it through the circular passage left between the two cylinders; which passing it accurately closes by means of a packing composed of hemp, tallow, or other substances used in steam engines for that purpose. *q q q q* shew the manner of packing the top and the bottom plates of the cylinder *G*, and of the valves *K* and *L*, to prevent the escape of the steam between them and the top and bottom plates of the outer cylinder. This is alike in all these instances, but will be most readily understood by comparing Fig. 1. with Fig. 3, which shews the parts to a large scale. *r* is a circular groove sunk in the inner surface of the plates *D* and *E*, and concentric to the axis of the cylinder *G*, and of the valves *K* and *L* respectively. In this groove is placed a metal packing ring *s*, and it is then to be filled up with a packing, against which the surfaces of the said plates of *G*, *K*, and *L* work; and this packing may be tightened in any degree necessary by the screws *s s s s*, which press upon the back of the packing-ring. It is proper to notice, that these circular rings of packing should, in a small degree, intersect each other at *1*, to prevent the steam from escaping between them into the vacuum parts of the engine. *Q Q* are chases filled with packing, to prevent a similar escape of the steam behind the valves. The steam-float *P* is to be packed in its place by means of the circular aperture in the top plate *E*, which aperture must be securely closed by a plate fitted into it, and confined by a strong dog; or the packing may be introduced by holes in the outer cylinder *C*, which may be closed in a

somewhat similar manner; but this mode is considered as less secure when steam of great elasticity is employed. It is evident, that if steam of sufficient force be admitted through the hollow shaft A, it will fill the lower division of G, and passing through the hole 6 into the circular passage already described, where (the valve L being first placed across the said passage), it will act upon the steam-float P, with a power proportioned to its elasticity and the area of P, and thus force it round till it passes the valve K, the steam before it finding a vent by the hole 7, into the upper division of G, and so through the shaft B into the condenser. If now the valve K be shut, the re-action, as it is termed, will take place against it, and the valve L may be opened to allow free passage to the steam-float. These valves are placed in the required position by the working gear.\*

*(To be continued.)*

**STRENGTH OF COHESION OF WOOD.**—The following results of his experiments, on the strength of cohesion of wood have been arranged by Mr. Bevan, in a tabular form, and communicated by him to an eminent scientific journal. Mr. B. having occasionally found part of the larger end of the wooden bars drawn out in a cylindrical shape, when the lateral adhesion was less than the longitudinal cohesion; the number of pounds expressive of the cohesion is, in these cases, short of what is due to the specimen, and in the table these are expressed by +, as to the other bearing: sometimes the specimen broke during the motion of the weight, and therefore would have separated under a less force with more time; these are marked —

| SPECIES OF WOOD.     | Spec.<br>Grav. | Cohesion<br>in lbs. | SPECIES OF WOOD.                         | Spec.<br>Grav. | Cohesion<br>in lbs. |
|----------------------|----------------|---------------------|------------------------------------------|----------------|---------------------|
| Acacia .....         | ·85            | 16,000+             | Lime-tree .....                          | ·76            | 23,500—             |
| Ash .....            | ·84            | 16,700—             | Mahogany.....                            | ·87            | 21,800—             |
| Do.....              | ·78            | 19,600              | Do. ....                                 | ·80            | 16,500—             |
| Beech .....          | ·72            | 22,200              | Maple .....                              | ·66            | 17,400              |
| Birch .....          | ·64            | 15,000              | Mulberry .....                           | ·66            | 10,600              |
| Box .....            | ·99            | 15,500              | Oak (English).....                       | ·70            | 19,800              |
| Cane .....           | ·40            | 6,500               | Do. ....                                 | ·76            | 15,000              |
| Cedar .....          | ·54            | 11,400              | Do. (old) .....                          | ·76            | 14,000              |
| Chestnut (Horse) ... | ·61            | 12,100—             | Oak Pile out of the }<br>River Cam ..... | ·61            | 4,500               |
| Do. (Sweet).....     | ·61            | 10,500              | Oak (blk. Linc. Log)                     | ·67            | 7,700               |
| Damson .....         | ·79            | 14,000              | Oak (Hambro') ....                       | ·66            | 16,300              |
| Deal (Norway Spruce) | ·34            | 13,100—             | Do. (Do.).....                           | ·66            | 14,000              |
| Do. ....             |                | 17,060—             | Pine (Petersburg) ..                     | ·49            | 13,300              |
| Do. (Christiana).... | ·46            | 12,400—             | Do. (Norway) .....                       | ·59            | 12,400              |
| Do. (Do.).....       | ·46            | 12,300—             | Do. (Petersburg) ...                     | ·55            | 13,100              |
| Do. (Do.).....       | ·46            | 14,000              | Poplar.....                              | ·36            | 7,200               |
| Do. (English).....   | ·47            | 7,000—              | Sallow.....                              | ·70            | 18,600              |
| Elder.....           | ·73            | 15,000              | Sycamore .....                           | ·60            | 13,000              |
| Hawthorn.....        | ·91            | 10,700—             | Teak (old).....                          | ·53            | 8,200               |
| Do....               |                | 9,200—              | Walnut .....                             | ·59            | 7,800               |
| Holly.....           | ·76            | 16,000—             | Willow .....                             | ·39            | 14,000              |
| Laburnum.....        | ·92            | 10,500—             | Yew .....                                | ·79            | 8,000               |
| Lance Wood .....     | 1·01           | 23,400—             |                                          |                |                     |
| Lignum Vitæ.....     | 1·22           | 11,800—             |                                          |                |                     |

\* Specification of Patent.

**LIST OF EXPIRED PATENTS.—Continued from p. 288.**

**HOBSE-SHOES.**—To John Lewis, of Half-Moon Street, Piccadilly, Surgeon, for improvements therein. Dated Oct. 31st, 1812.

**RAISING WATER.**—To Col. Wm. Congreve, of Cecil Street, Strand, for combining a power for raising of water to the tops of buildings, &c. Dated Oct. 31st, 1812.

**REFINING SUGAR.**—To Edward C. Howard, of Westbourn Green, Middlesex, for a process for refining sugars. Dated Oct. 31st, 1812.

**WATER POWER.**—To Peter Nouaille, of Seven Oaks, Kent, for a method of saving water for mechanical purposes. Dated Oct. 31st, 1812.

**WINDOWS, &c.**—To Benjamin Cook, of Birmingham, for a new method of constructing doors, sashes, blinds, screens, &c. Dated Oct. 31st, 1812.

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**TO OUR READERS AND CORRESPONDENTS.**

A **CONSTANT READER AND ADMIRER**, appears to be under a mistake relative to the Platinum lamp of Sir H. Davy; it is only employed as a means of lighting tinder or a match, in lieu of flint and steel. The light given out by the incandescent wire is of course very feeble. No additional heat is required, after the first ignition of the wire, which will continue red hot until all the alcohol or ether be evaporated. With respect to his separate enquiry, how a decanter may be rendered "luminous without the aid of fire," he may employ phosphoretted oil (phosphorus dissolved in olive oil) for this purpose, with which the bottle should be only partly filled, that there may be a free admission of atmospheric air. As the solution of these queries appear to be of great importance to the writer we would suggest to him to put them in a more definite form; to state the circumstances and the situation of the required light, &c.: we would then put the enquiry into our work, and probably some of our ingenious scientific readers would take pleasure in giving some satisfactory information on the subject.

**Mr. SCHEFFER** is informed that we had prepared a notice of his improved inventions, but could not make room for it in the present Number.

**Mr. W. COULING's** favour was not received until after our present impression had been completed: we could have wished that the subject of it had not been previously extensively published. Will **Mr. C.** have the kindness to call or send to No. 14, Paternoster Row.

**T. B.** has been received. We shall endeavour to give a description of a Machine for Cutting the Teeth of Wheels in an early subsequent number: in the mean time, we dare say he could get a sight of one by application to some of the respectable clock manufacturers in Clerkenwell.

**THE QUERIES** respecting the power of Water Wheels will be inserted and replied to in our next.

**Mr. LBBERTSON's** favour has just come to hand; his Communication will be highly acceptable.

**Mr. WIMBLE** we thank for the suggestions contained in his Letter. To his inquiries we regret our inability at the present moment to give any satisfactory answers. With respect to **Mr. Cheverton's** New Gas Power Engine, inserted in our 69th number, we have not heard what progress has since been made in its completion. Perhaps that gentleman, who is one of our subscribers, will favour us with a communication on the subject.

**W. COLE, JUN.—A MECHANIC,—S. JAMES,—**and the paper on Elastic Pistons for steam engines, (*without signature*) have been received, and will meet with our earliest attention.

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*Published by L. HEBERT, 14, Paternoster-row; where Communications for the Editor (post paid) are to be addressed.*

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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**Fig 1.**

**Fig 2.**

**PORTABLE STEAM ENGINE,**

EMPLOYED AT THE EAST LONDON WATER WORKS.

## PORTABLE STEAM ENGINE,

EMPLOYED AT THE EAST LONDON WATER WORKS.

A CORRESPONDENT has kindly favoured us with a drawing of a very compact and effective Portable Steam Engine, of 8-horse power, recently employed in draining at the East London Water Works. We understand that it is only hired by the Company, and has been occasionally used in several public works; being moved about, from place to place, wherever its powerful services may be required. The parallel motion possesses considerable novelty, and is not without its advantages: the annexed engraving sufficiently illustrates this, and the other parts of the machinery, together with the following explanation of the letters of reference.

Fig. 1 is a side view, and Fig. 2 an end view; the letters of reference applying to the same parts in each figure.

*a a*, connecting rods; *b*, air-pump rod; *c*, cold water pump rod; *d*, hot water pump rod; *e*, throttle valve; *f f*, induction and eduction valves; *g*, piston rod; *h*, fly wheel; *k*, crank; *l*, eccentric; *m*, the wheel, to which the pump rods are attached when the engine is used for draining: the dotted lines show the parallel motion at the middle and bottom of the stroke.

SCHEFFER'S LIFE PRESERVERS, *Improved.*

In one of our early numbers, (N<sup>o</sup>. 6,) is given a descriptive account of Mr. Scheffer's Life Preservers. This invention is a decided improvement upon all previous contrivances for the same purpose, chiefly on account of its convenient portability, and having *no seam*, which renders it perfectly impervious to both air and water; while it is so extremely light and elastic, as to be not easily susceptible of accidental injury in the use. The process of manufacturing them of the skins of animals, without a seam so neatly, is highly curious; it is a manipulation known only to the ingenious contriver, and which he retains at present as a secret, that he may reap some advantage from so useful a discovery; at the same time we believe he is disposed, for a reasonable consideration, to instruct another person in their manufacture.\* The good sense and proper feeling of Captain Parry, or of those persons who had the outfit of the vessels destined for the perilous voyage to the northern polar regions, have induced them to take out *fifty* of Mr. Scheffer's Life Preservers: in these an improvement has been made, which is too valuable for us to omit a notice of.

In the preservers previously made by Mr. Scheffer, there existed a *possibility*, when in use, of the air cock being struck by some floating substance, by which the air might escape and leave the wearer unsupported. To prevent the possibility of such an accident, Mr. Scheffer has fitted them with cocks of the following construction.

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\* Would it not be an act of good policy as well as humanity, in the Lords of the Admiralty becoming the patrons of this invention, by giving Mr. Scheffer a moderate remuneration for it?—Ed.

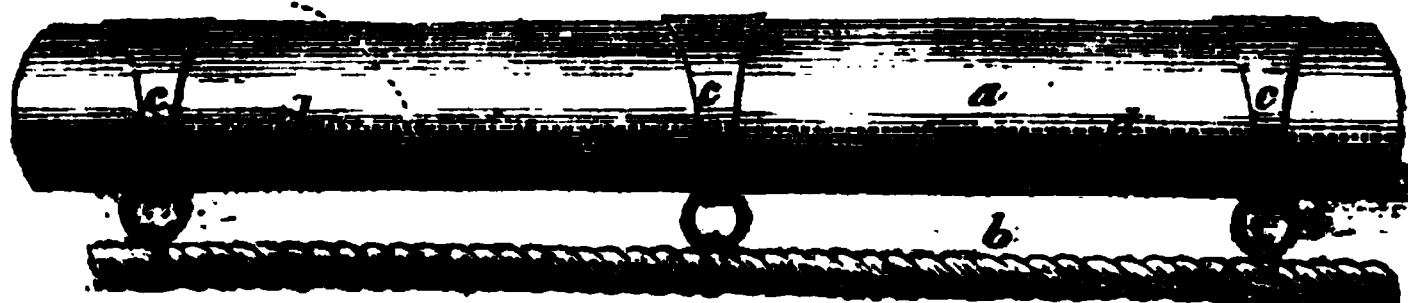
*a* is the nozzle of the cock, which is screwed into the elastic air vessel: *b* an ivory pipe, screwed into the barrel, used when desired as a mouth-piece to inflate the air vessel; when that is effected, the handle, *d*, of the plug is turned, so that the hole, *e*, is brought round opposite to the end of the bolt, *f*, when the spiral spring, *g*, projects the bolt into *e* and *locks* it fast. The hole, *e*, is perforated through the plug, so that the locking takes place whether the plug be turned to the right or to the left. Thus the cock is secured from being opened by accident, and allowing the air to escape. To open the air passage it is necessary to draw and hold back the spring bolt with one hand, while the other turns the handle, *d*, into the position shown.

### SCHEFFER'S IMPROVED ROPE FLOAT.

WE have now to bring under the notice of our readers a new and important adaptation of the Life Preservers; that of floating a rope from a stranded ship. Numerous plans have been proposed by different individuals to effect the same object, but we question much if there are any of such easy practicability as the present. Unlike Bell's, Manby's, or Singrouse's, it places the means of communication in the power of those on board the vessel at all times, as the wind which drives the vessel ashore will also float a rope, when buoyed up by such light vessels exposed to the action of the wind. On this subject we have the authority of an experienced officer in the navy for stating, that casks or spars which have been often employed for a similar purpose very ineffectually, are greatly inferior to Mr. Scheffer's; that when casks or spars are employed, the lives of the men passing along the floating line are constantly endangered by being struck with them. The weight of such apparatus likewise keeps the floats in deep water, consequently out of the influence of the wind, so that the tide may carry out the rope in a contrary direction to that which is required. With Scheffer's buoyant vessels lying on the surface of the sea, the wind would have so powerful an effect, as to render the course of the tide immaterial: the passengers and crew might then with security pass along the rope to the shore.

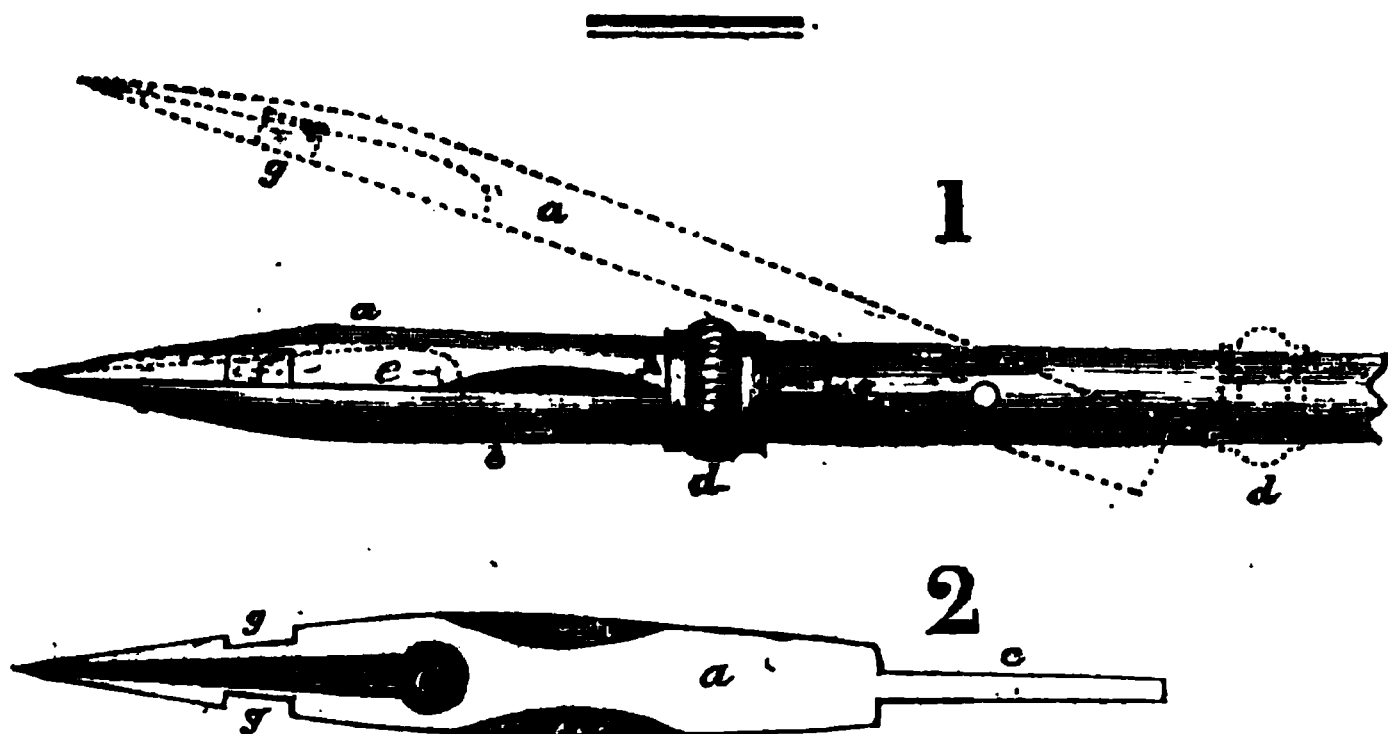
In a heavy breaking sea it often happens that a boat cannot possibly approach a ship without being dashed to pieces, but by the agency of these floats, a rope being carried ashore and drawn 'taught

tight,' the persons on board the vessel may slide down the rope clear above the dangerous breakers close about her.



*a* is the air-vessel or float, for the rope, *b*, which is suspended by rings to the bands, *c c c*; *d d* is the water line or depth at which it lies immersed when the rope is attached.

We are likewise informed by the experienced seaman before-mentioned, that in the event of sending the rope from a stranded ship to the land, a hen-coop, spar, skylight, buoy, or grating, should be fastened to the end of the rope; or a small raft may be attached to it, upon which a grapnel, or small anchor, may be floated to land, or be laid out by the boat which comes off to render her assistance. The raft, when it contains an anchor, is floated by attaching some of the air vessels to it; and to the grapnel or anchor should be a strong rope, for the people on shore to get hold of. A ship having thus laid out a small anchor might, with the assistance of back-sails, be enabled to heave off the shoal.



### FRENCH DRAWING PEN.

THE above represents a French Drawing Pen, (on a scale *double the real size*) which was lately presented, by Mr. Bryan Donkin, to the Society of Arts. It is calculated to make lines of only one uniform thickness; the cavity which contains the ink being enclosed all round, keeps it free from dust, and prevents it from drying and clogging the drawing point so quickly as those of the ordinary construction.

Fig. 1 shows the pen with the handle broken off; *a* and *b* are the two limbs, jointed at *c*, and held close by the sliding-ring *d*; the

dotted lines represent the upper portion, *a*, as opened, to receive the ink, with the ring, *d*, slid back beyond the joint.—Fig. 2 shows the under side of the limb, *a*, in a separate state; at *c* is the hole to receive the centre pin; *e* is the cavity for the ink; *g g*, notches for receiving two projecting pieces, as shown at *f*, Fig. 1.



### CAPTAIN HALLIDAY'S PATENT WIND GUARD.

THE apparatus delineated above is the invention of Capt. Francis Halliday, (R.N.) of Ham Lodge, Surrey; a great many of them have been made and sold by Mr. Peek, the engineer, in St. John Street, Clerkenwell; experience having proved them to be very effectual cures for what are termed smokey chimneys.

The construction is so obvious in Fig. 1, that little need be said in explanation. *a* and *b* are two square plates of iron, or other metal, the upper one being supported by four vertical pillars. *c* is the aperture for the passage of the smoke from the brick flue directly beneath; across this aperture a bar is fixed horizontally, having in the middle a conical steel bearing or centre, to receive the end of an upright shaft, *d*, the upper extremity of which carries a double winged vane; this vane being of a peculiar figure, and better adapted to be operated upon by the wind than any we have hitherto seen, we have given a plan of it separately, by Fig. 2. The guard (Fig. 1) is a flat rectangular plate, *e*, fixed by horizontal arms to the upright shaft, *d*, which shaft being turned by the action of the wind upon the vane, uniformly presents the plate against the wind. The advantage of the flat plate appears to us to consist in its causing the current of air to take a direction at right angles with its previous course, which allows the smoke to escape into a comparatively still atmosphere, without opposition. When the guards are curved as in the ordinary cowls, a current is produced in a circular direction, (a sort of little whirlwind) which destroys in a great measure the effect of the screen.

In situations exposed to a *prevalent* current of wind, the patentee has an additional security against its evil effects. This consists in the suspension of a flap to the upper plate, *b*, which completely closes up one of the sides whenever the wind is opposed to it. It is suspended by loose joints, and is poised accurately by a balance weight, so that the slightest breath of wind from the opposite side of the machine keeps it open. We forgot to make this addition to our drawing previous to sending it to the engraver's; the wind guards may, however, be seen fitted up with this addition, and modified in various ways, according to circumstances, at Mr. Peck's shop in St. John Street.

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### London Mechanics' Institution.

A QUARTERLY General Meeting of the Members of this Institution was held on Wednesday, the 7th of this month, for the purpose of receiving a Report of the Proceedings of the Committee of Managers. The purposes of the Institution are in full operation, and seem to be carried on with much activity and advantage to the members—there being Lectures on every Wednesday and Friday evenings; a Reading Room open daily, and a Circulating Library, containing nearly 3000 volumes; as well as Elementary Schools for instruction in Arithmetic, Mathematics, Drawing, French, Geography, and Writing; besides classes for mutual instruction in Mechanical Philosophy and Chemistry. These privileges are all obtainable for the very moderate subscription of 24s. per annum.

During the meeting it was announced to the members that Professor MILLINGTON would commence a course of lectures on Pneumatics on the 14th of this month, and that these would be followed about the middle of April by a course of lectures on the Structure and Functions of the Human Body by Dr. BIRKBECK, the President.

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### "THE GLORIOUS UNCERTAINTY OF THE LAW."

Our readers have, we doubt not, been generally informed through the medium of the newspapers, of a trial that took place last week in the Court of Common Pleas, respecting some engravings inserted in this Work. As the reports of this trial were exceedingly brief, and almost wholly confined to an ex-parte statement of the opposite counsel, which had nothing whatever to do with the real facts of the case, as appeared in evidence, we feel it due to our readers as well as to ourselves, to add the following explanation of the matter.

In a work like ours, which is chiefly devoted to the giving of descriptive accounts of new mechanical inventions, we have always considered that the most valuable information was to be obtained from the Specifications of Patents. Accordingly we have made it a part of our regular business to visit the several offices in Chancery, where these documents are laid open to the inspection of the public, on the payment of the customary fees. In this part of our duty we have inspected and studied more than 100 specifications of patents, the chief properties of which we have described in a more or less condensed form to our readers. The labour and difficulty attending the execution of this task our readers may well conceive, when we inform them that it is contrary to the rules of the enrolment offices to permit a single memorandum, word, or line, to be taken down or sketched, which makes it necessary

for us to go several times to examine some subjects, before we can perfect our drawings, and complete the intelligence contained in the written document: the fees have to be paid each time.

Another and the most productive source of information relating to patent inventions, we derive directly from the patentees themselves, who have the kindness to lend us a copy of their drawings and specifications for publication. In very numerous instances we make the drawings from the machines as they stand.\*

The publication of such subjects in the Register of Arts has, unfortunately, excited not only the jealousy, but the bitter animosity of Mr. W. Newton, Draughtsman in the Enrolment Office, who it appears had taken upon himself the publication of these matters for his individual benefit. This gentleman is said to be the proprietor of the London Journal of Arts, which he supplies with copies of the enrolled drawings in his office; the circumstances of his situation probably affording him the means of obtaining them free of expence; but these copies are, generally, so altered by him from the originals, that highly useful and valuable inventions are made to appear in his journal, by the metamorphosis of his pencil, as perfectly absurd and useless. Of this fact we will undertake to PROVE very numerous instances, if called upon by him, or in defence of the patentees, whose interests are thus wantonly sported with.

It has generally been our good fortune to be the earliest in procuring and disseminating information upon important new inventions and discoveries; in many subjects, on the contrary, we follow our contemporaries in the order of publication. Though we generally precede the London Journal,† whenever it happens that we publish a subject subsequent to it, Mr. Newton declares it to have been copied out of his work; than which nothing can be more ridiculous, notwithstanding the verdict of a jury, which having been given directly contrary to the evidence, we have no doubt of having soon reversed.

In the declaration, the plaintiff (Mr. Newton) charges the defendants (Publishers of the Register) with having copied, "in the whole or in part," nine engraved diagrams from the London Journal, (*none of the letter-press, but only the engravings*); five of the subjects were, however, abandoned at the trial, as too absurd to bring forward, these were—

Stevenson's Patent Axle trees,  
Tulloch's Patent Machinery for Sawing Stone,  
Broadmeadow's Patent Blowing Machines,  
Benecke's Patent Zinc Furnaces,  
Harcourt's Patent Castors:—

upon these five counts, therefore, a verdict was demanded for the defendants, which the plaintiff's counsel was compelled to accede to.

The four subjects proceeded upon were as follow:—

Murray's Locomotive Engine,  
Goodman's Patent Loom,  
Yardley's Patent Glue Apparatus,  
Wright's Patent Bleaching Machinery.

MR. FREDERICK POLLOCK stated the case to the jury, at great length, the substance of which we shall endeavour to put into a small compass. The plaintiff's work, he said, was got up with *great care*, the descriptions in it were *most accurate and perfect*. That he, (*the plaintiff! who is draughtsman in the patent office!*) went to the patent office, where, at very great expence, he paid for copies of the enrolled drawings and specifications of patent machinery. That the drawings thus obtained he reduced by great skill to suitable dimensions for publishing engravings of them in his work. The learned gentleman afterwards, with great ingenuity, descanted upon the excellence of

\* The Editor being a mechanical draughtsman and engineer, is likewise professionally employed by Patentees in preparing drawings and specifications of patents for enrolment: after which, with the consent of the patentees, they are faithfully described in this work.

† We were prepared to prove in court, but were not permitted, that Mr. Newton had followed us in no less than thirteen subjects in a single month; in these, too, the resemblance to our engravings was infinitely closer than the subjects we succeeded him in, charged as having been copied by us from his work.

the English Laws, which protected *originality of design*. This attempt to throw dust into the eyes of a certain portion of his auditory was, unexpectedly, very successful, although the cajolery of it excited the risibility of almost every body else in court.

Mr. POLLOCK next proceeded to describe, in glowing terms, the heinousness of our offence. The defendants, he told the jury, never went to the patent office;\* they never paid for copies.† No, they went a cheaper way to work, they took the plaintiff's engravings, and, *by means of thin paper, traced fac-similes of them*, which he said was evident, by their being in every respect *similar in dimensions*, only reversed. In consequence of this copying, the defendants were enabled to compete with the plaintiff at a great advantage, for while he sold his London Journal at 2s. 6d. they sold the Register of Arts, containing the same subjects, at 4d.

The learned counsel took about an hour to state these and other irrelevant matters, when he proceeded to call his witnesses. The first was Gladwin, the engraver of the subjects in the plaintiff's work.

Gladwin was of opinion that the Locomotive Carriage was copied by us from the London Journal. He said it was *not exactly a fac-simile*, it *measured the same in all its parts*. Upon cross-examination he said *the size of the cylinders was the same, but the distances between them were different, they would be found to be so if measured with a pair of compasses*, (pray mark this, gentle reader.) *The position of the wheels was different; their form was different; the axles were very different, which he allowed to be a very material variation; there were connecting bars from wheel to wheel in the defendants' elevation, but not in the plaintiff's; there was a safety valve in the defendants' boiler, but not in the plaintiff's; the steam pipe was differently curved, and fixed in another part of the boiler*. In fact, he failed to point out any one part in the defendants', in which there was an identity with the plaintiff's; and when asked, indignantly, by our counsel, if he thought that it was copied by tracing paper, he replied "*no, that is impossible!*" This witness was not further examined.

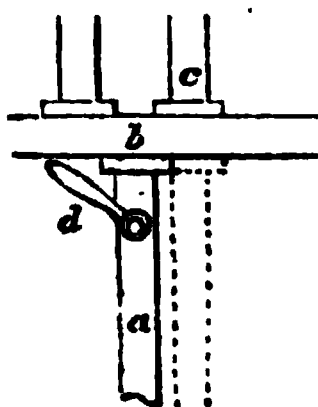
The next that came up into the box gave his name, John Farey, junior. Mr. Farey was of opinion that we had copied the Locomotive Carriage from the plaintiff's journal: the reason he gave we could not comprehend the sense of; we took down these words: "*they were too unlike for both to be copied from the same drawing or model: knew all that was going forward at Messrs. Fentom, Murray, & Wood's manufactory, at Leeds; the carriage was never built; there might be a model or drawing, of which other persons might possibly obtain a knowledge besides Mr. Newton*. Acknowledged, upon cross-examination, that *there were MANY material variations*. Seeing the effect of this confession, he corrected himself by saying *there were some*. The cross-examination being continued, he corroborated all those strong facts in our favour which had been reluctantly drawn out of the preceding witness, except in one particular, wherein he directly contradicted him; he said, that *the sizes of the cylinder were different, BUT THE DISTANCES WERE THE SAME*. A pair of compasses being now employed to measure them, he said that *THE DISTANCES WERE ALSO DIFFERENT!* This witness likewise omitted to point out a cylinder, a valve, a pipe, a rod, a beam, a wheel, an axle, a furnace, a boiler, or any one part, however minute, in which there was the least identity. Every answer given by him, as well as by the preceding witness, proved the impossibility of their being copies. In fine, it is not the size, the shape, and the position only of the constituent parts that are different, but the *view of the machine is also different*; in consequence there are many parts brought into view in our's which are not at all to be seen in the plaintiff's. Had the machinery of the carriage, as drawn by the plaintiff, been set to work, the front wheel only would be turned round, while the carriage would not advance a foot; and if the carriage were propelled by another power the boiler would infallibly burst.

\* From the frequency of our visits we are almost as well known there as any person in the office; as a proof of which, the gentleman at the head of it, with his uniform politeness, has often requested us to pay the fees at the next time of our calling, for want of change.

† This was the first truth the learned gentleman uttered; we never have paid for copies;—and it is not likely that we ever shall. The cost would be about £10 each, the greater part of which would, of course, go into our opponent's pocket!!

The same witness was examined upon the other three subjects. Goodman's Patent Loom he thought was a copy; when asked for his reasons he said he had none to give; and he gave none, either good or bad.

The next subject,—Wright's Patent Washing and Bleaching Machinery,—Mr. Farey considered to be also a copy from the plaintiff's work: the reasons he gave were, that we had made two mistakes in common with the plaintiff, one in the drawing and the other in the letter-press. Having been very careful in making our drawing from the original, this circumstance rather astonished us at first, and our counsel were unprepared to reply to it. It consisted merely in having connected the vertical pipe, *a*, to the horizontal pipe, *b*, in the situation drawn, instead of being opposite the pipe, *c*, as drawn in the original, and as shown by the dotted lines in the annexed diagram. The



drawing of this subject was made by us nine months ago, and we recollect, perfectly, making the alteration in these pipes, from observing that it was extremely improper in practice to cut two great holes opposite each other in a pipe, by which its strength would be so much impaired; and especially of importance, when it is considered that these pipes have to withstand the elastic force of steam at a very high pressure: the talents of an engineer, who would fix the pipes in the way they are drawn in the original, would be justly called into question. Therefore it appears, for having

done right, we are charged with copying from our contemporary. Upon cross-examination the witness said that the circumstance of the situation of the pipe was immaterial, and we freely confess that, had there not been evident proofs in ten other places in our drawing, that we had taken from the original, and not from the copy of it in the London Journal, we should be compelled to admit, notwithstanding we had put the pipe in the most advantageous position, that it afforded a reasonable suspicion against us. But in this point only is there any identity between the two drawings, our's conforming to the original in every respect, and particularly so in ten different places where the plaintiff's varies from it. The original drawing being here produced in court, it was admitted by the witness and the court to be as we have stated, as respected eight of these variations: this was demonstration sufficient that we had drawn from the original and not from the copy of it. Some other points of resemblance to the original were, however, reserved by us to cross-examine the next witness upon, but we were not allowed the opportunity, by the plaintiff not calling any other witness. These points we cannot mention at present, as they will be brought forward on the new trial, for which we intend to move.

It is proper we should now explain the other fact urged against us, which, though it had nothing whatever to do with the matter at issue, took us by surprise, as we were not aware of its existence. It appears that we had fallen into the same error as our contemporary, with respect to Mr. Wright's christian name, by writing it Samuel, instead of Lemuel.—It was stated in court, that we had put Samuel at the bottom of our engraving, instead of Lemuel. Such, however, is not the fact, as our readers will find on reference to our 81st number; it is, however, printed in the letter-press on the next page. Whether that was our printer's error or our own, we cannot now positively tell, but we have been, since the trial, to the enrolment office, to see the specification again. At the commencement of that document, which consists of a long preamble respecting the conditions of the grant, the word *Lemuel* is plain enough in a common hand: but, as we uniformly never read the preambles, being nearly the same in all patents, we at once pass them over to get at the descriptive part of the invention; and here we found the name frequently recurring, in the old fashioned engrossing running hand: upon the closest examination, of which the word *Lemuel* appears to us so like Samuel, that we do not for the life of us, know where the difference between the two lies; and we are quite certain, that ninety-nine persons out of a hundred would read it Samuel as well as ourselves.

Now had we been charged with copying a line of the plaintiff's letter-

from description, this proceeding would have been more fair, and we should then have met the charge by shewing, that our letter-press contained various matter from the original document, which the plaintiff took no notice of whatever in his publication. (Such as the material of which the pipes and vessels were formed, and various other circumstances relating to them.) We would here inquire, by what rule of logic, the circumstance of our having made a mistake in a name in our letter-press, afforded a proof of our having copied an engraving? Yet these two trifling circumstances, (i. e. the peculiar junction of the pipes before mentioned, and the error in the name), it would appear had more weight with the jury, than eight peculiar modes of drawing certain parts of the apparatus by us, like the original, and different from the plaintiff's.

We now come to the fourth and last charge, Yardley's Patent Glue Apparatus, and the decision upon this is perhaps the most extraordinary

upon record. In the plaintiff's work, there are two gross misrepresentations of the original drawing, making a very excellent machine appear to be perfectly ridiculous. In one place he puts a wheel *w* on an axis, which is of no possible use or application. That we may not be misunderstood, we annex an engraved fac-simile of this part of his drawing. In our engraving we have put simply a wheel and pinion, that being all that is wanted, and all that is mentioned in the specification. We have likewise made the pinion as wide as the wheel, which every mechanic, who knows his business, would not fail to do.

The other gross mistake of the plaintiff, consists in his having drawn the end of the pipe which is to convey steam among the bones in the vessel, as closed, instead of being open, as we have drawn it. We have added a drawing of these two pipes in the margin, as the jury made use of an observation to the court on this subject, which shewed their utter incapacity to judge of matters of this kind. There certainly was neither a draftsman nor an engineer amongst them, or such an assertion could not have obtained their sanction.

"Both pipes being in section, they are, therefore, both open," was the reiterated assertion: by which, of course, they supposed that the real machine contained the longitudinal section of a pipe. Our pipe is represented with the end open as at *o*; the plaintiff's with the end closed as at *s*.<sup>\*</sup> What will our mechanical readers say to this?

Mr. John Farey, the only witness examined on this subject, of the glue apparatus, considered our drawing to be a copy of the plaintiff's, from two circumstances, first, because we had given the same extract or portion of the original drawing, as the plaintiff; secondly, because we had put a tub in our drawing, as well as the plaintiff, when there was none in the original. These were his only reasons. Now the patentee, (Mr. Yardly, of Camberwell), expressly declares in his specification, that portion only of the drawing, which we have had engraved, to be all that is new, and all that is of his invention. Were we bound to go to the expence of extending our engraving, or of filling up our book with stale and uninteresting matter, because our contemporary had given only the novel part of the glue apparatus, as expressly mentioned by the patentee? When the witness was cross examined as to this point, he said he had not read the specification—he had not had time, he had only seen the original drawing for a few minutes at a coffee-house near



<sup>\*</sup> We can unfold some very curious tales respecting the metamorphoses of our friendly and liberal contemporary, but we shall reserve our fire until his next attack, he having threatened to lay out a large sum to effect our destruction.

Guildhall; which were the original drawings that the defendant's lad had brought up from the enrolment office for their defence, should it become necessary to prove a negative.) This was his excuse, and thus one of his two reasons was exploded. The other reason, the placing of the tub, is also expressly recommended in the specification to be so placed. When the witness was cross examined on this point—*he had not read the specification*—and thus his second and only reason was exploded, and there remained not even the “fabric of a vision” to support the plaintiff's case; moreover, it was shewn, that we had not fallen into the gross absurdities of the plaintiff, consequently, it was incontestibly proved, that we had made the drawing more conformably to the original, than the plaintiff had done:—that ours was correct and just in every particular, while his was not only shamefully incorrect, but monstrously absurd.

We now appeal to every person who was present in court, whether we have not fairly and impartially stated the whole facts of the case, as they appeared in evidence. We had in waiting several of the most respectable artists and first-rate draftsmen, who had thoroughly examined all the drawings, as our witnesses, we had also all the original documents from which our drawings and engravings were made, ready to produce in court, to prove a negative to every one of the nine counts. But the plaintiff having abandoned five of his counts, and the remaining four having been clearly disproved by his own witnesses, our counsel reasonably concluded that it would be a waste of the time of the court, (already occupied more than five hours upon this contemptible and vindictive piece of business), to call witnesses to annihilate that, which had already been clearly proved to have no existence. Mr. Serjeant Wild, (our counsel), therefore simply replied in a most energetic and talented speech; he contrasted the evidence elicited, with the charges preferred, clearly shewing their want of foundation.

The learned judge (Mr. Justice Gazelee) summed up the evidence, and left it to the jury to decide whether the defendants had availed themselves of the plaintiff's book, or not; if the jury thought they had done so, they would find a verdict of one shilling damages upon each of the four counts, or upon such of them as they might so find.—In the course of his lordship's summing up, he made use of an unfortunate expression, calculated to injure us, (no doubt unintentionally) in the minds of the jury; in order to distinguish this publication from the plaintiff's, he made use of the term “*the copy*,” instead of saying the *alleged* copy.

The jury retired for a few minutes, taking with them the respective publications: on their return they brought in their verdict for the plaintiff, damages one shilling on each of the four counts! A verdict for which we cannot, upon any principle of common sense, or common justice account for.

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## History of the Steam Engine, Chap. V

*Continued from p. 383.*

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It is our business next to describe the inventions of Mr. R. Wilcox, of Bristol, whom we have already noticed in another part of this chapter. He obtained a second patent in 1805, for a number of rotative engines, which are, in our opinion, exceedingly ingenious. The work, entitled Stuart's History of the Steam Engine, has passed over the contrivances of this gentleman, by remarking that they vary from Mr. Flint's only in some trifling alterations of the cocks and steam pipes. But it will be seen that this is extremely incorrect, as some of the plans described differ entirely not only from Mr. Flint's, but from every previous attempt of the kind.



*Fig. 1* is a vertical section of one of his plans as attached to the common condenser for the purpose of shewing one of the most simple and compact arrangements, where the steam is condensed. A the outside case or cylinder fixed to the framing of the condensing cistern,

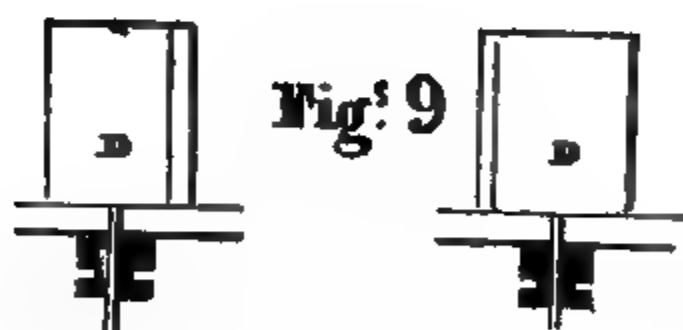
or any other more suitable and convenient framing that the engineer may find most appropriate or suitable to the locality of the premises, where the engine is to be erected. B B the inside or revolving cylinder, attached to and connected with the vertical shaft, which is the first mover, and which gives a rotative power to any description of machinery requiring the same, through the medium of a spur wheel fixed to the said shaft, when a vertical motion is required; or with a bevil gear wheel, where an horizontal motion is wanted. C C moveable pallets, gates, or valves, for regulating the operation of the steam in the engine; one of the said pallets, &c. is attached to the fixed cylinder A, and the other to the interior cylinder B, as is more distinctly seen in *Fig. 2*, and the references annexed. D the steam valve for the admission of steam between the said pallets, E the exhausting valve for the egress of steam. The gear required for opening and shutting the valves D and E, and for opening and shutting the said pallets or gates C C, is so nearly similar to that of common engines, that it would be useless to describe it more than the said valves D and E require to be opened and closed at the same time, whereas, in general, they are opened and shut alternately by the plug tree, or other simple and well known means. F the top of the cylinder, composed of a ring of metal, for pressing the packing round the moveable cylinder, the lid is screwed down with screws, as is usual in securing the lids or tops of cylinders. G G two rings of metal pressed by screws, from a lever secured to the top of the cylinder F, for compressing the packing, and securing the joint of the cylinders A B. H H a circular channel into which the revolving cylinder B works, for the purpose of preventing the ingress of air or other fluids into or by the said interstice or channel, and which is packed with hemp and grease, and pressed in such manner with a ring as thereby to render the engine more efficient, by keeping it perfectly tight. I the common condenser, the air pump of which, is wrought by studs or stops projecting from the horizontal shaft, or any other simple or effectual way the engineer may think proper, as is more distinctly seen in *Fig. 3*, which is the end view of the shaft, and the side view of the piston rods; the operation of which is so obvious, as not to require elucidation. *Fig. 2* exhibits the bird's eye view of *Fig. 1*, with the top of the cylinder and compressing rings removed, to show the operation or apparatus for opening and closing the pallets, gates, &c. and also part of the flanges removed to show the situation of the valves. The letters of reference in this case of *Fig. 2*, are placed upon the same parts of the engine as in *Fig. 1*, which it would be superfluous to recapitulate. C C the pallets, &c. formed of two or more pieces of metal; one part of the said pallet is permanently secured to each cylinder A and B, whilst the other part or parts turn on a joint or hinge; which said joint or hinge is made steam tight or secured, together with the whole of the edges coming in contact with the cylinder, with a hemp cloth stuffed, wadded, or folded together, or by other similar materials, capable of stopping the passage of steam, and which must be screwed or

otherwise fastened on the front of the said pallet; and by the pressure of the steam it is pressed or brought in contact with the said pallet or cylinders, and thus it effectually prevents the escape of steam, or other fluids by or with which the engine is wrought. K K two racks and pinions communicating by a straight and parallel bar, working through a stuffing box in the sides of each cylinder, whereby the said valves are opened and shut, whilst passing each other, from the external part of the engine by a piece projecting from the upper or lower part of the fixed cylinder, which may be placed at the option of the engineer; which said piece in its passage comes into contact with the gear connected with the said pallets, and thereby with any of the well known simple methods or gear used for opening and shutting of valves in the present steam engines. The gates, &c. of the engine are opened and shut as occasion requires. L, *Fig. 2* exhibits a second gate, &c. which in this case slides backwards against a straight parallel surface during the time the pallet in the revolving cylinder is passing when the said gate is sliding by the gear against the revolving cylinder, as in the drawing. The said gates may be opened and closed in a variety of ways, such as a spindle ground into the bottom of the fixed cylinder, and connected by a link to the gate internally, or a crank or compound lever may be applied instead of the rack and pinion externally.

In another plan Mr. Wilcox proposes a piston firmly fixed to the interior cylinder, and instead of gates or pallets, he has a plate of metal which is drawn into a recess as the piston passes, and returned immediately into the cylinder, so as to become an abutment for the action of the steam.

In this plan A is the outside stationary cylinder. B the inner cylinder. C the top of the cylinder and rings, as in *Fig. 1* and 2; already explained. D a plate of metal, as represented by the dotted lines, made very straight, smooth, and parallel, as it respects its thickness. E a small shaft or axle, working through a box, or a receptacle fixed on the outside of the cylinder A, allowing room sufficient for the said plate to drop clear off to the bottom of the cylinder, whilst an accurate incision is made in the bottom and side of the cylinder sufficient to admit the said plate D to slide freely up and down, which is effected by a rack and pinion, or lever, or any other simple contrivance attached or connected to the extremity of the shaft E; by which means the steam is caused to act on the same or a similar principle, as in *Fig. 1*. F, *Fig. 4*, presents a second way of producing the same effect, namely, that of raising a plate of metal through an incision made in the bottom of the cylinder A, from a box fixed underneath the cylinder, through the medium of a parallel bar working through a stuffing box; whereby the said plate D is raised or depressed, as the working of the engine requires.

“*Fig. 5* is the bird's-eye view of *Fig. 4*, with the same general letters of reference to their respective parts, as in *Fig. 4*. K the steam passage. L a passage leading or communicating with the condenser, when the steam is required to be condensed. Here it may be necessary to remark, that, although the plate D is shown as rising upwards, as being the most convenient way; nevertheless, the boxes



necessary to receive the plates may be placed above the cylinder, and the plates may be raised in an oblique instead of perpendicular direction.

*(To be continued.)*

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**IMPROVED BAROMETER:**—Much ingenuity has been displayed in contriving methods whereby the mercury in the cistern of a barometer may be kept at a constant level; floating gauges, moveable bottoms,

&c. &c. have been had recourse to, all more or less objectionable, either from the insufficiency of the means employed, or the difficulty of their application. An extremely simple but admirable contrivance of Sir H. Davy has supplied the desideratum. The pinion that raises the vernier by which the height of the mercury is led off, depresses at the same time, and in the same degree, into the reservoir, a steel plunger, the size of which exactly corresponds to the interior diameter of the tube of the instrument.—*Monthly Mag.* Feb. 1827.

### LIST OF EXPIRED PATENTS.—Continued from p. 384.

**TYPE-FOUNDING.**—To Wm. Caslon, Jun., of Dorset Street, Salisbury Square, for an improved printing type. Dated Oct. 31st, 1812.

**WATER PIPES.**—To Joseph Bramah, of Philico, for certain improvements in constructing, laying down, and organizing the train and other pipes for supplying the metropolis and other towns with water, and applying the same to other useful purposes. Dated Oct. 31st, 1812.

**WINDOW BLINDS.**—To R. Salmon, of Woburn, Beds. for improved guards and shades for windows.—Dated Oct. 31st, 1812.

**SMEETING.**—To W. E. Sheffield, of Somers' Town, for an apparatus and furnaces for separating metallic or other substances from their ores. Dated Oct. 31st, 1812.

**CARPETS.**—To Thomas Lea, of Kidderminster, for certain improvements in the making of carpets. Dated Oct. 31st, 1812.

**PRUNING SHEARS.**—To Edward Jukes, of Walworth, for an instrument for pruning trees, gathering fruits, &c., denominated the *AVERRUNCATOR*. Dated Nov. 7th, 1812.

### LIST OF NEW PATENTS SEALED, 1827.

**SUBSTITUTE FOR THE CRANK.**—To Robt. Barlow, for a new combination of machinery, for superseding the ordinary crank used in steam-engines. Feb. 1. Six months.

**GAS.**—To J. F. Daniell, Esq. of Gower Street, for improvements in the manufacture of gas. Feb. 1. Six months.

**PROPELLING APPARATUS.**—To John Oldham, of Dublin, for improvements in the construction of wheels, designed for driving machinery, which are to be impelled by water or by wind; also for propelling boats, &c. Feb. 1. Six months.

**CAPSTANS AND WINDLASSES.**—To Ralph Hindmarsh, of Newcastle upon Tyne, for an improvement in the construction of capstans and windlasses. Feb. 1. Six months.

**AIR ENGINE.**—To Robt. Stirling and James Stirling, Glasgow, for improvements in air engines for moving machinery. Feb. 1. Six months.

**PISTONS.**—To John White, of Southampton, for improvements in the construction of pistons or bucket valves. Feb. 1. Six months.

**LAMPS.**—To Sam. Parker, of Argyle Place, Westminster, for improvements in the construction of lamps. Feb. 1. Two months.

**MOULDINGS, &c.**—To A. A. M. Marbot, of Norfolk Street, Strand, for improved machinery for working wood into all kinds of mouldings, cornices, &c. Feb. 3. Six months.

**NEW MOTIVE POWER.**—To Sir Wm. Congreve, of Cecil Street, Strand, for a new motive power. Feb. 8. Six months.

**STEAM HEAT.**—To Wm. Stratton, of Limehouse, for an improved apparatus for heating air by means of steam. Feb. 12. Six months.

**COPPER PLATE PRINTING.**—To John Geo. Christ, of Bishopsgate Street, London, for improvements in copper or other plate printing. Feb. 14. Six months.

**SPINNING.**—To Philip J. Heisch, of America Square, London, for improved machinery for spinning cotton. Feb. 20. Two months.

**GAS-HOLDERS.**—To C. B. Coles, Esq. and W. Nicholson, of Manchester, for a new method of constructing gasometers, or machines for holding gas, &c. Feb. 20. Six months.

**SEED-CRUSHING.**—To Wm. Benecke, Esq. of Deptford, for an improved machine for crushing seeds, and other oleaginous substances, and for extracting the oil therefrom. Feb. 20. Six months.

**SMEETING.**—To W. Jefferies, of London Street, Ratcliffe, for improvements in calcining, roasting, smelting, &c. metallic ores, &c. Feb. 20. Six months.

**PIANO FORTES.**—To Pierre Erard, of Marlborough Street, for improvements in the construction of piano fortes. Feb. 20. Six months.

**PAPER MAKING.**—To Augustus de la Garde, of St. James's Square, for a method of making paper from the ligneous parts of certain plants. Feb. 20. Six months.

**CUTLERY.**—To Wm. Smith, of Sheffield, for an improved method of manufacturing cutlery, &c. by means of rollers. Feb. 20. Six months.

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# REGISTER

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## WILLIAMS & DOYLE'S PATENT APPARATUS

For separating Salt from Sea-water, and rendering it fresh.

VOL. IV.

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# WILLIAMS AND DOYLE'S PATENT APPARATUS FOR SEPARATING SALT FROM SEA-WATER, AND RENDERING IT FRESH.

THE patentees of this invention are Mr. John Williams, iron-monger, and Mr. John Doyle, merchant, both of the Commercial Road, Middlesex; and if the statements contained in their specification be true, it is really one of very great importance. To separate the salt from sea-water, by simple percolation through a body of sand under mechanical compression, and thereby render it fresh, appears to us so extraordinary, that we should be somewhat sceptical of the fact,\* were we not persuaded that the patentees must have repeatedly proved it to be the case before incurring the expense of a patent-right. We have had no communication with either of the patentees on the subject, (having merely read the specification at the patent office, where it has just been enrolled); but should either of those gentlemen favour us with the details of their experiments with the apparatus, we are sure they would be read with much gratification, and probably, be conducive to their advantage from the great circulation of our work among the shipping interest.

The preceding engraving, though it does not embrace all the drawings attached to the specification, sufficiently illustrates the process and one of the modifications of its construction.

*a* is part of a cask supposed to contain sea-water; *b* a tube descending therefrom, made fast by bands, *c c c*, to the filtering apparatus, *d d*, which is a strong square trunk of wood, lined internally with sheet lead, which is cemented to it, that the water may find no passage between: this part of the apparatus is given in section that the construction and arrangement may be seen in one view. *e* lower chamber, where the water is first received; *f* a strong stool of open frame work, supported upon five stout legs *g*. (A plan of this stool is given in a separate figure F, the situation of each of the five legs being marked with a *g*.) Over this stool frame is nailed a plate of copper, pierced with numerous small holes:) this plate of copper is also shown by a separate figure H. Over the perforated copper plate are several layers of woollen cloth or woven horse hair, *i*, and above these a body of sand *k*, filling up the entire trunk: on the top is placed a sliding cover *l*, which is operated upon by a strong screw *m*, working through a fixed nut *n*, which is supported by curved iron arms extending from the opposite sides of the trunk.

The sand having been compressed by the agency of the screw, into a more dense and compact mass, is prevented from rising by the pressure of the water, which percolating through the minute interstices to regain its level, deposits its salt, and runs out of the pipe *o* in a fresh state, into a vessel *p* placed to receive it.

When the sand has become saturated with salt, it is to be removed by taking out the screw and the pressing board *l*. The main holes

---

\* May not some of the fresh water springs which are found near the shores of the sea, derive their source from the ocean, the salt being deposited as the waters rise through the superincumbent earth?

It may then be opened, by unscrewing the plugs, when the other materials may be easily shifted. These matters being completed a fresh quantity of sand may be taken from the ballast of the ship, and the process of filtration be repeated as before. The sand that has been saturated with salt in this manner serves still *as ballast*, and, on the arrival of the ship in port, and the discharge of her ballast, it is considered that *the salinous sand will form an excellent compost for manuring land*.

### GERMAN BORING BIT.

(From the Transactions of the Society of Arts.)

THE boring bit, of which the following is a description, was met with by Mr. Donkin, in Germany, as it appeared to him as it did subsequently to the Society, that it might be in some cases a useful addition to the implements already used in this country. The instrument is very simple, enters the wood easily, bores rapidly, and forms a clean hole.

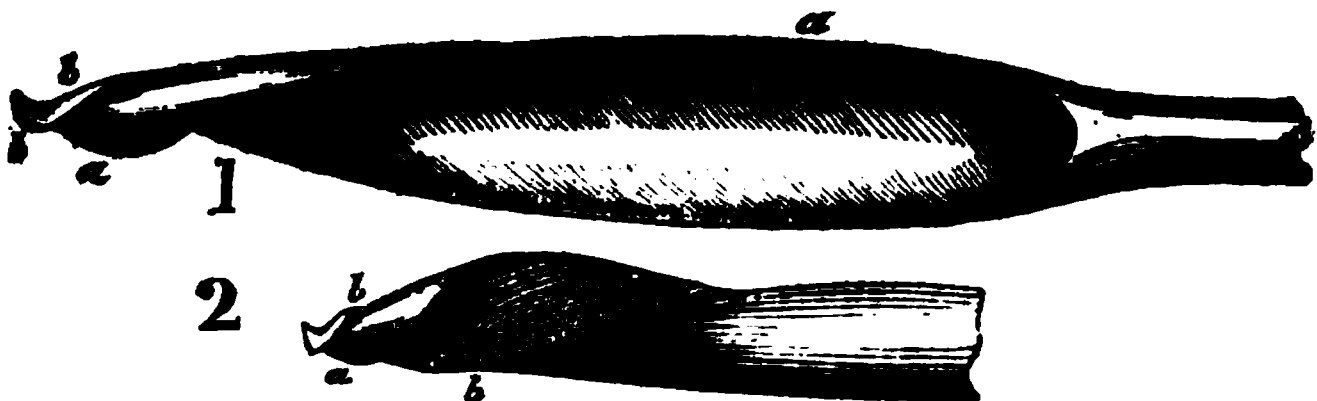


Fig. 1 a front view of the bowl of the boring bit; *a a* the cutting edge; *b b* a thread or fin winding round the back, which acts as a screw to draw the bit into the wood. Fig. 2 is a side view of the same.

### PRATT'S PATENT CHAIRS, SOFAS, &c.

MR. PRATT, the trunk maker, of New Bond Street, has lately patented a new method of stuffing chairs, sofas, &c. by means of fine twisted iron wire, which, by its superior elasticity is said to form an improved substitute for curled horse-hair. The editor of the Literary Gazette, who, it appears, has provided himself with a library chair of this construction, is quite in ecstasies with the ease and comfort which it confers. He observes (in N<sup>o</sup>. 530)—

“ This is, certainly, the *beau ideal* of ease and luxury; and with what material does the reader suppose it is stuffed?—It is of iron! iron wire!! This, complicated and twisted into spiral forms, like baked horse-hair, composes the seat, the arms, the back, of Mr. Pratt's verily Easy Chair. Down itself could not be more gentle, nor caoutchouc more springy. For the invalid it is invaluable; yielding to pressure, yet never settling into solidity or lumpiness;

and having another rare advantage, that of not heating the body reposed on it. For sofas and beds the same material may be advantageously employed; and from what several eminent medical friends have stated to us, we have no hesitation in saying that, for health as well as pleasantness, this invention is superior to any hitherto applied in the same way." \* \* \* \*

The same writer notices another invention of Mr. Pratt's in the following terms.—

"It is a mechanical apparatus, forming a ship couch or chair, the object of which is to prevent (and it must in a great measure) that distressing malady, sea-sickness. The frame is disposed something like the compass; but the contrivance is so perfect, that the chair or couch swings and yields to resistance in *every direction*, so as completely to neutralize the effect of a ship's motion! The interior of the cushion or seat is farther constructed on a novel method to counteract the plunging motion of the vessel, that is to say, it resembles the delightful and elastic articles which we have just been describing—chairs which always retain the same shape, and beds that never require making!!!" \* \* \* \*

## BLIND FOR CIRCULAR-HEADED WINDOWS.

SEMICIRCULAR windows, and rectangular windows with semicircular heads, are common in modern churches and chapels, and in most rooms for public meetings, as well as occurring occasionally in private houses. In the square parts of such windows, blinds of various well-known constructions are inserted, in order to exclude, when necessary, the rays of the sun; but the heads are either left without blinds, or are fitted with awkward and imperfect contrivances to effect the desired object. Mrs. Goode's blind answers its purpose very effectually, and is both neater than any other, as well as sufficiently simple to recommend itself to general adoption.

Fig. 1 is an elevation of the arch of a window; *aa* a metal tube bent so as to fit the head of a window, and serving as a circular curtain rod; this rod is open all along the upper edge, as shown in the section, Fig. 2; the ends fit into holes at *b* and *c*, made through the window bar *d*; at *b* a pulley is fixed, corresponding with the holes and bore of the bent tube *a*; an endless band, *eee*, Figs. 1 and 2, enters the tube *a* by the end *c*, goes out at the other end, passes under the pulley *b*, then crosses the window below the bar *d*, passes over the pulley *c*, and then over a spring catch or rack-pulley below, not shown in the drawing.

In order to make the blind, a piece of cloth is taken a little wider than the height of the arch, and rather longer than its circumference, and is folded like a fan; a nail is then passed at the bottom through all the folds, into the middle of the window bar at *d*, forming a centre to the semicircular tube *aa*; holes are made at the other end in the folds, which allow the blind to slide along the tube; the bottom fold is tacked to the window bar near the end *b*; two pieces

of tape connect the upper fold with the endless band, by passing through the split tube as shown.

The blind is drawn over the window, or withdrawn from it, according as one side or the other of the endless band is pulled, as in the common roller blind.

The inventor of this excellent contrivance, Mrs. Henry Goode, of Ryde, Isle of Wight, was presented by the Society of Arts with their *Silver Vulcan Medal*, during their last session: a model of the blind is placed in the Society's repository.

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### HOWARD'S PATENT VAPOUR ENGINE.

*To the Editor.*

Sir,

I HAVE to point out an error in my observations on the Vapour Engine inserted in your 77th Number. The fifth column (only) of the table of vapours at page 71 must be considered erroneous, and so much of the remark following it as is founded upon it. I am not prepared to give a statement that can be relied upon, of the effect produced within the cylinder from the moment of injecting the liquid, to the termination of the motion produced by the expansive power of the vapour, because the investigation is difficult, and must be verified by more exact experiments than I have yet made. It is sufficient for the present to observe, that upon the injection of the liquid there is instantaneously produced a great pressure (which may

be modified at pleasure), and which pressure decreases as the space within the cylinder increases by the receding of the surface pressed upon, the operation being in this respect, *in part*, analogous to the expansive Steam Engine of Watt.

By inserting this communication in an early number of your Work, in order that it may afterwards appear in the same volume with the error alluded to,

You will oblige, Sir,

Your obedient Servant,

24th February, 1827.

THOMAS HOWARD.

### CAREY'S IMPROVED DEAD EYES FOR SHIPS.

(From the Transactions of the Society of Arts.)

SIR,

Bristol, April 19, 1826.

ONSAVING the very awkward manner in which they set up our men-of-war's lower and top-mast shrouds, which strains the lanyards to pieces, often breaking them and rendering the same lanyards almost useless for a second time; and with what difficulty the lanyards render over the rough grain of the elm wood, of which the dead eyes are usually made, in consequence of which the shroud is with great difficulty set untight. I have made a simple improvement, which I beg leave to lay before the Society for their approval. Half sheaves of lignum vitæ fixed in the dead eye will cause the lanyard to render with greater facility than it does at present, and the shroud will be set up in half the time. I have sent a loose half-sheave, to show the manner they are fixed in, by which it will be perceived they cannot come out; for the more pressure there is on them the faster they are.

I am, Sir, &c.

To A. Aiken, Esq.

EDWARD CAREY.



Fig. 1 the dead eyes; Fig. 2 a section; and Fig. 3 one of the sheaves, formed of pieces of nicely-turned lignum vitæ, which is let into each hole, as shown in the section.

### London Mechanics' Institution.

At the conclusion of a moral and instructive Lecture on Prejudices, delivered and rendered particularly interesting by Mr. Cham-

bers, on Friday, the 23rd of March, Dr. Birkbeck, the president, announced that Mr. Stackhouse would commence a Course of Lectures on the Architectural Antiquities of Britain, on Friday the 31st.

Professor Millington continues his Course on Pneumatics, as usual, on the Wednesday evenings.

### NEWTON'S JOURNAL *versus* THE REGISTER OF ARTS.

It is with unfeigned pleasure we make the following extract from the *Mechanics' Magazine*, on the subject of the recent prosecution instituted by Mr. Newton. Our readers will perceive, the argument is founded on the supposition that we had copied some engravings from the *London Journal*; this charge, we are most anxious to repel; for among all the Works ever published pretending to communicate accurate and scientific information, we place Mr. Newton's as the very lowest; and we know of no greater degradation to which we could be reduced, than to copy from such a work. Our pages have frequently furnished his *Journal* with much valuable information, to that (for the sake of science) he is quite welcome: the hatred of our contemporary we must however be content to bear, being convinced it is the unfortunate penalty 'that patient merit of the unworthy take.'—

"It is commonly observed, that those who have the least to be vain of, are always the vainest, and the most pugnacious in the defence of the little which is their's; and it is even so, we find, with the owner and getter-up of the publication to which we have just alluded.—While, among the editors of all other scientific works—even those of the highest reputation for talent and originality—it has been the practice to borrow from one another accounts of new inventions and improvements, without any one murmuring or complaining (provided only a due acknowledgment of the obligation is made); and this, not only from a feeling of proper liberality towards one another, but from a desire (superior to every personal consideration) to see every new addition to the common treasury of knowledge made as extensively known as possible; while such is the practice of all our most respectable and useful journalists—the Brands, Brewsters, Jamesons, Gills, and Phillips's of the day;—the Editor of this thing of copies, called 'The *London Journal*,' for almost every letter and line of which he is indebted to that common storehouse of the public—the Patent Office,—which is made up of matters that are open and free to every one,—which scarcely ever contains a single original contribution of its own to the arts and sciences,—*this feeder on the public common* (he of all others!) has recently thought fit to declare war against the general usage, and to call the laws to his aid, to harass and punish every one who, innocently confiding in that usage, may have made the slightest use of the few of his copies that are worth re-copying.

"The first appearance of Mr. Newton in the courts (if we recollect right) was as an applicant to the Vice-Chancellor for an injunction against some one who had published an account of a new patent, with drawings so like those in Mr. Newton's *Journal*, (pity that a name so illustrious in science should ever be seen in hostility to its interests) that there seemed every reason to believe they were made from his copies, and not from the originals in the Rolls Office. His honour, however, scouted the idea of any one establishing a copy-right in drawings that were the common property of the public, and refused the injunction.—Noways abashed by this reproof from the second highest legal authority in the country, Mr. Newton resolved to try what an action at common law could do for him; and in this, we regret to say, he has so far succeeded as to obtain, the other day, a verdict of damages (against the publishers of the *Register of Arts and Sciences*) for the same sort of transgression which the Vice-Chancellor refused to recognise as furnishing any

ground for his equitable interference. We have heard, too, of other actions having been instituted and compromised, under the terror of the verdict thus obtained.

"We have no intention of entering here into a discussion of the question of legal right which Mr. Newton's proceedings involve. Possibly the Vice-Chancellor may have been in error, and the common law in the right. Strict justice may require that a copy of an engraving by one man (even though a copy) shall not be copied at second hand by another. Considering, however, that any person, by going a few doors farther down Chancery Lane than Mr. Newton's shop, could obtain a copy of the same engraving from the original drawing, and make what use of it he pleased, without Mr. Newton or any one being entitled to call him to an account, we must be allowed to give it as our opinion, that there is no coin of so small a denomination which would not more than a thousand times repay Mr. Newton for any damage of which such a case fairly admits.

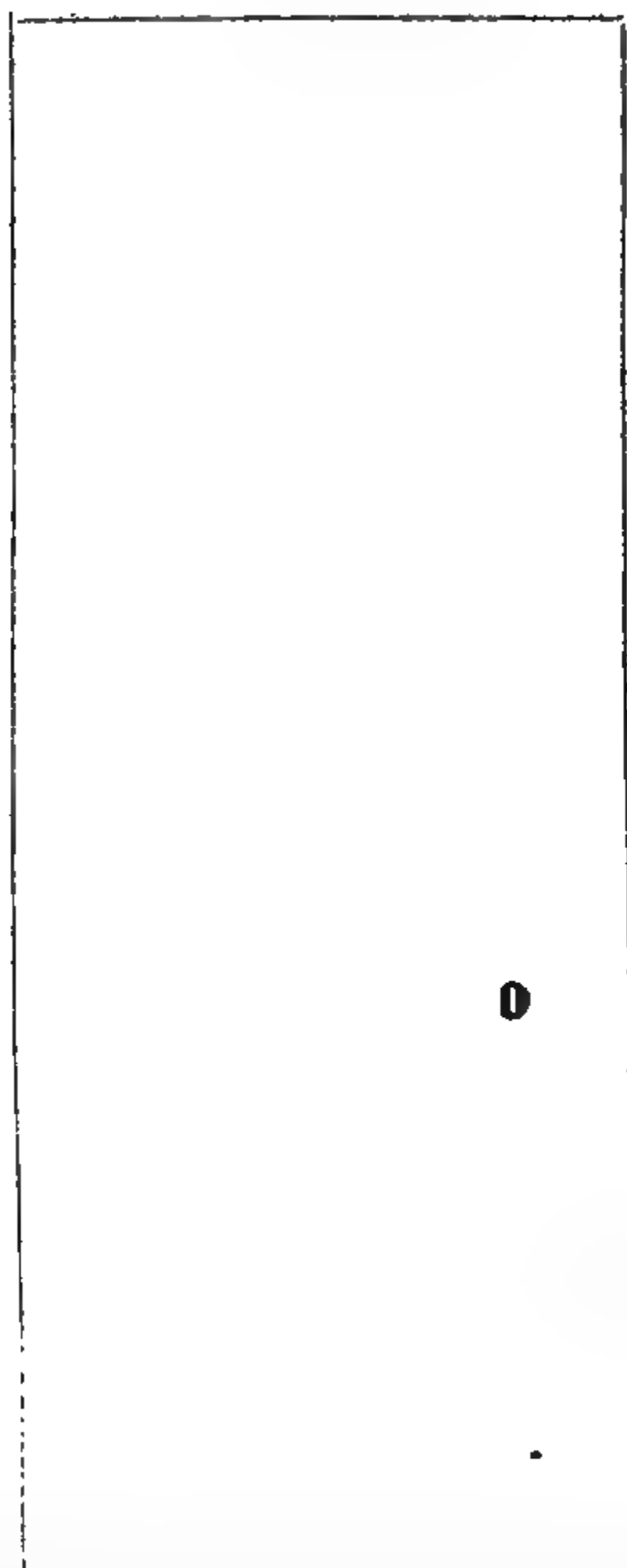
"Our business, however, is not with the law, but with the decencies of the case. Let it be granted that Mr. Newton, or any other publisher of accounts of new inventions, whether in the first or second instance, has a right to inflict the prodigious injury of a lawsuit (for be the damages however small, the expenses are always enormous), and the same upon any one who copies from him; it is such a right as, we make bold to say, not many other persons besides Mr. Newton would have thought or ever think of enforcing. It is a right not only oppressive towards the luckless offenders, but one which, if generally put in force, would be most injurious to the progress of knowledge, and of course to the interests of every individual of the community; injurious to inventors, to whom it is of the greatest importance to have their inventions published every where, in order that they may reap without delay the largest possible benefit from them; injurious to all men engaged in scientific inquiry and improvement, whose researches may be materially aided by early information of what others have done or are doing; and injurious to the public, which is more or less benefited in proportion as the channels by which information is conveyed to it are untrammelled and free. To nobody, in short, but to some one who prefers a paltry gain to all other interests, can it be of advantage, thus to make a *preserve* for himself of what should be borne on the wings of the winds to every part of the earth. We are not even sure that it will, in the long run, be of advantage to such a would-be exclusive; for there is a possible consequence of such conduct as Mr. Newton's, which we suspect he has not taken into account. The few readers of his 'journal' are chiefly of the scientific and inventive class; it depends upon this class, in fact, for its very existence. We have reason, too, to know, that in many instances Mr. Newton has been saved the expense of procuring copies from the Patent Office,\* by soliciting and obtaining from patentees the loan of their original drafts and drawings. But does Mr. Newton suppose that inventors and men of science will continue to patronize a publication which opposes itself so flagrantly to their interests? Does he imagine that patentees will step willingly into his patent trap, when apprized, as they now are, that if once caught in it, they may chance to be held fast there for ever? Has Mr. Newton reflected sufficiently how men may be affected by the conviction, that to have an account of a new invention first inserted in his 'journal' is a sure way to deter every other journalist from giving it publicity, lest Mr. Newton should fasten on him an action for piracy and damages?"

## **History of the Steam Engine, Chap. V**

*Continued from p. 399.*

"Fig. 8 is the plan of another rotatory engine. A the outside fixed cylinder. B the inner or revolving cylinder. D D two or more

\* The intelligent writer appears not to be aware that Mr. Newton is the person employed at the Harbours Office, in copying the drawings of Patentees upon the Rolls. [Edit. Reg. of Arts.]



pallets, working through a deep stuffing box, and turned by a lever or other power from the external part of the engine alternately flat or edgewise; the pallets D are fixed to the revolving cylinder; E is the steam passage, that to the condenser not being shown.

“ Fig. 10 is the bird's-eye view of a rotary engine, as wrought with a cock or portion of a circle, whereby a similar effect is produced as in Fig. 1, by or with a portion of circles: in these figures, 8, 11, the lids of the cylinders are removed, and a part of the flanges where the circles or irregular cocks are used is broken off, to render the working parts conspicuous. A, the outer or fixed cylinder. B, inner or revolving cylinder. C C, the pallet, cock, or portion of a circle, fitted accurately into the circle it prescribes; with a spindle working through the top of the cylinder. D, the groove, into or against which the part coming into contact with the revolving cylinder is secured with a piece of hardened metal, in order that the constant friction of the revolving cylinder shall not injure the pallet or cock. E the passage to the boiler. F the passage to the condenser. G the pallet secured to the working cylinder. In this figure two portions of circles and cocks are introduced, for the purpose of showing clearly their situations in different places, the same as in Fig. 10.

“ Fig. 11 exhibits the bird's-eye view of a rotatory engine, as wrought by a cock or cocks, which regulate the steam instead of valves, and also act as the principal cock or pallet in the said engine. A the outer fixed cylinder. B the inner revolving cylinder, with a fixed pallet. C C the cocks, which are wrought from the external part of the engine, by a spindle passing through the top. D a piece of hard metal, introduced into the said cock, to resist the friction of the revolving cylinder, as explained in Fig. 10. E, steam passage. F, passage to the condenser.”\*

The first of Mr. Wilcox's plans (1 and 2) is, as far as we know, perfectly original. Its great complexity has been, no doubt, a great cause of its abandonment; if, indeed, it was ever tried. The number of racks, pinions, gates, pallets, joints, grooves, slides, and stuffing boxes, must instantly impress the mind of every one with an idea of its great inferiority to the most complex reciprocating engine.

The second scheme, (4 and 5) it will be perceived, resembles in its general principle one of Messrs. Bramah and Dickenson's engines, a description and plan of which will be found at page 70 of this work. The objections, therefore, which have been made against that plan, will apply equally to Mr. Wilcox's.

In the third plan (Fig. 8) we apprehend that a great waste of steam would arise from the difficulty of making the pallets, D, unite sufficiently close at the joints; besides that the complexity would be nearly as great as the first plan.

The fourth and fifth plans (10 and 11) resemble that of Mr. Flint's so nearly that we doubt not they failed from the same cause.

In the year 1807, Mr. Henry Maudslay, of London, obtained a patent for a Portable Engine, in which he introduced several ingenious improvements on the valves and working parts of steam engines, which tended not only to reduce the friction, but altogether to render them tighter and more compact. The accompanying figure will enable our readers to understand what these improvements were.

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\* Specification of Patent.

A represents a frame of thin cast iron, for the purpose of fixing the cylinder. BB are two cold water cisterns, of merely sufficient size to admit of easy access to the pumps within them; they communicate with each other by a pipe *a*. C is the cylinder surrounded by a casing (*b*) of copper or other material. The space between the cylinder and casing is filled with wool or some other imperfect conductor of heat; D is the piston rod joined to smaller rods carried down on each side of the cylinder to E, and having an opening or division so as to avoid interfering with the main shaft. These rods are at their lower ends fixed to a wheel F, with a fluted rim: from the centre of which a connecting rod, G, is carried to the end of the crank. The wheel F runs between two guides, *c c*, so as to preserve the rectilinear motion of the rods E, and the piston rod D. H is the crank, a three-throwed one. J a cross beam for working the pumps

P O M; its motion is procured by having a fork underneath it, which embraces one of the cranks H, on which is a roller for reducing friction. By this means the fork, and consequently the beam and pump rods, is reciprocated by the revolution of the shaft. K K is the fly wheel; L is the condenser, containing the air pump M; N is the hot water cistern, and O the hot water pump; P the cold water pump; Q the injection cock; R the steam pipe from the boiler to the cylinder; S the eduction pipe. The steam is admitted into the cylinder by a four-way cock, which differs from that generally used by its being considerably more taper, which effectually prevents it from *jamming* by unequal expansion or contraction, an evil to which the common cock is liable.

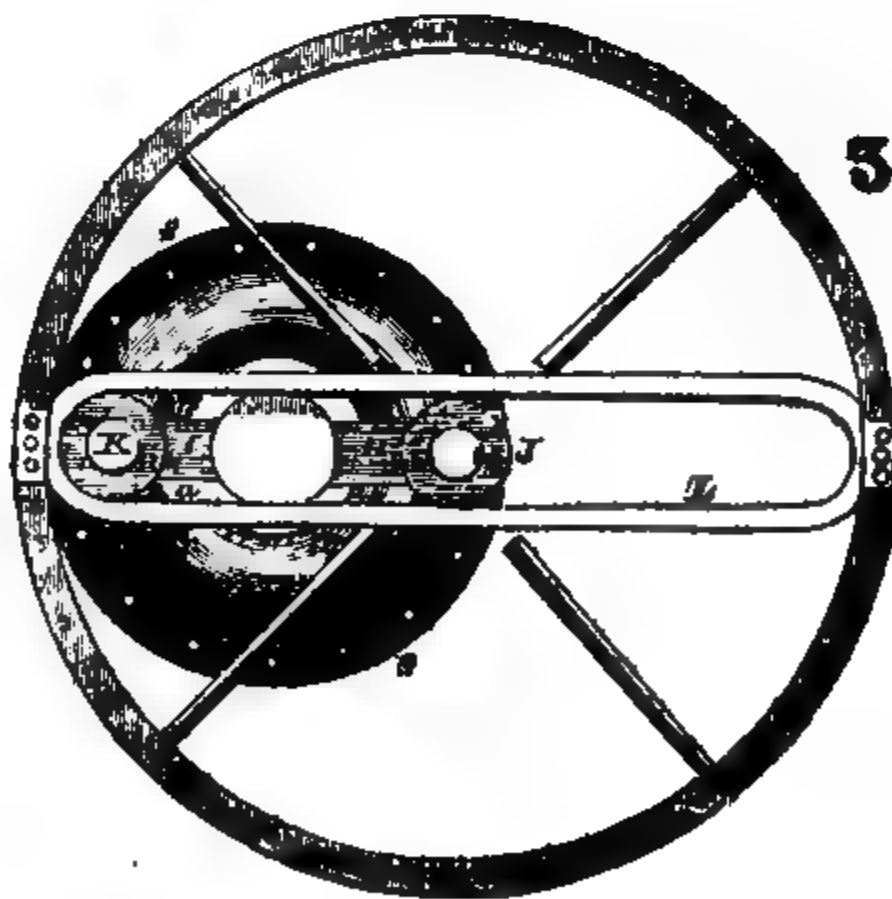
There are few machines which display more ingenuity, either by skilful arrangement or neatness, than this; and, as it regards its utility, it need only be said that long continued trials have fully established the great excellence of Mr. Maudslay's engine. We do not pass over this machine, therefore, with so short a description on account of any doubt respecting its merits; for were the length of our remarks to be governed by our opinion of the utility of any machine, they would in this instance extend over several pages. But however beautiful may be the arrangement of Mr. Maudslay's engines, this is not their sole merit; for Mr. M. has, by superior workmanship, and most careful attention to the selection of good materials, obtained the reputation of being one of the best manufacturers of steam engines in the world.

## CHAPTER VI.

CONTENTS.—MEAD'S ROTATIVE ENGINE.—CLEGG'S STEAM WHEEL.—CHAPMAN'S STEAM WHEEL.—WITTY'S ROTATIVE FROM RECTILINEAL MOTION.—ONION'S STEAM WHEEL.—BLENKINSOP'S LOCO-MOTIVE ENGINE.—BRUNTON'S LOCO-MOTIVE ENGINE, OR MECHANICAL TRAVELLER.—DODD AND STEPHENSON'S LOCO-MOTIVE ENGINE.—TREVITHICK'S ROTATIVE ENGINE AND IMPROVED STEAM BOAT.—TURNER'S ROTATIVE ENGINE.—LOSH AND STEPHENSON'S IMPROVED LOCO-MOTIVE ENGINE.—ROUTLEDGE'S ROTATIVE ENGINE.—MALAN'S IMPROVEMENTS.—SIR W. CONGREVE'S STEAM WHEEL.—WRIGHT'S ENGINE.—PONTIFEX'S IMPROVEMENTS.—RIDER'S ROTATORY ENGINE.—MASTERMAN'S STEAM WHEEL.

—We stated in our remarks on Hornblower's Steam Wheel, (described at page 77) that it had been claimed as an original invention many years after Mr. Hornblower obtained a patent for it, we alluded to the patent of Mr. T. Mead, of Hull, dated 1808, the specification of which describes a machine resembling in principle, though of a somewhat different form, to this engine of Hornblower's.

“A and B, Fig. 1, are two circular plates or shells of metal, similar in their construction, having their insides turned, or otherwise made very true and correct; A has its inside uppermost, and B its outside uppermost. Each of these circular plates or shells have a flange and semicircular cavity formed for the reception of the pistons which are afterwards described, and a recess or hollow part formed round its centre for a small circular plate to turn in. Near to the edge of each recess is a small groove running quite round it; in the bottom of each groove is placed a metallic ring, O O, capable of



being adjusted by screws on the outside of each shell. At its centre is a hollow pipe or boss for the reception of the spindles, F and G. The plate A has also two holes, *a a*, Fig. 3, to which pipes are fitted, one to convey steam into the shells, the other to conduct it from them into a condenser, or wherever it may be required. C C two pistons with grooves round them to admit of a packing or wadding. D and E two circular plates to which the pistons are connected or made fast. F and G two shafts or spindles; the spindle G is made hollow to receive the spindle F, which passes through it. H and I two arms made fast to the two spindles; each arm, near its extremity, carries a wheel K and J, which are generally termed friction wheels. L a fly or a regulating wheel, fixed to one end of a shaft or moveable axis, having in its side opposite to its axis a groove running across its diameter for the reception of the friction wheels J and K, which wheels, when the pistons are put in motion, work in it, and give motion to the fly wheel and other machinery which may be connected with it. R R the hollow plates or bosses for the spindles to work in; S S flanges by which the shells are fastened together. Fig. 2 is a front view of one of the pistons, with its circular plate, arm and friction wheel; J the friction wheel; H the arm; D a circular plate, and C the piston. V V V grooves for the reception of the packing or wadding, which is to be made fast therein. When the engine is to be put together, the arms are taken off from the spindles; the spindle F is then to be inserted in the hollow spindle G, which, with their respective pistons, are placed in one of the shells, and the one shell placed over the other; the shells are then fastened together with screws or otherwise, so as just to admit the pistons with their respective plates and spindles to turn round in their channels nearly steam-tight; the arms may then be made fast on the spindles, and the engine erected. Place the direction of its axis in an horizontal or lateral direction, parallel with the direction of the axis of the fly, but nearly as much out of that line as the length of one of the arms, H and I, taken from the centre of the spindle to the centre of its friction wheel, and at such a distance from the fly as to admit of the friction wheels moving freely in the groove on its face. By so doing the axis of the engine will be placed eccentric with the axis of the fly. The engine may be fixed in an iron or wood frame, and the fly supported in the same or a separate frame, in the position before pointed out. If the fly is then turned half way round upon its axis, one of the friction wheels will remain locked or held fast in the groove near its centre, and the piston with which it is connected remain nearly stationary in the steam chamber, between the holes *a a*, while the other friction wheel, with its arm, spindle, small circular plate and piston, make nearly one complete revolution, round their common centre of motion, or the centre of the engine. If the motion of the fly continue till it has made one complete revolution round its own axis, the friction wheel which was locked or held fast in the groove near its centre, will move off in the groove towards the circumference of the fly, and with its arm, spindle, small circular plate, and piston, make nearly one complete revolution round their common centre of motion, or the centre of the engine,

and the other friction wheel in its turn remain locked, or held fast in the groove near the centre of the fly, and the piston with which it is connected remain nearly stationary within the steam chamber between holes *a a*; and so on, alternately, as long as the fly continues in motion. Instead of the hollow spindle *G*, and the solid spindle *F*; two other solid spindles may be used, by applying one to each small circular plate, and passing them through the opposite pipes or bosses, each having its arm and friction wheel as before, but working in separate grooves mounted on separate axles, and united by wheel work. When the engine is to be set to work by the force of steam, the steam is permitted to enter by one of the pipes into the steam chamber, where, by its elasticity, it will press or act upon both pistons nearly alike; and as one of the pistons is stopped or held fast by the aforesaid methods, the steam cannot pass into the other pipe that way, but will force the other piston round with its small circular plate, spindle, arm, and friction wheel, and put the fly in motion; and continue it as before explained. A similar effect may be produced with a concave globe or sphere, having within it two moveable semi-circular leaves, (as a substitute for the pistons) with packings at their edges, and united in the centre or axis of the globe with joints or hinges, and having each of them an axis passing through the globe to receive the arms and friction wheels as before described, and with holes and pipes for the admission of steam.\*

By referring to the aforesaid drawing of Hornblower's Engine it will be seen that principle of alternate revolution of two pistons is adopted, both in that and in this before us. But although there might not be that difference in Mr. Mead's engine to merit the name of an original idea, yet it is extremely ingenious; and the method whereby he has endeavoured to avoid the striking of the two diaphragms, is probably the nearest approach to a removal of that evil which we stated was the probable reason of the abandonment of Hornblower's plan. For here, by the aid of the fly wheel, the moving piston is gradually brought (like the piston of the reciprocating engine) to a state of rest, so that the striking would be almost done away with. This being the case, we feel much difficulty to satisfy ourselves as to the cause of failure: and, but for the assurance that it did actually fail, we should have almost expected that it would have exceeded in effect any rotative engine we have yet described. For although there is reason to believe that the wadding or packing would be torn out of its place in passing over the cavities for the admission and exit of the steam, yet that difficulty could be removed by the substitution of metallic packing. If this engine ever had a fair trial under circumstances where there were no local inconveniences, we confess we cannot see why its effect was not *equal at least* to that of a beam engine. It is true, the revolution is neither continuous nor equable, but this is no more the case with any engine in use, but on the contrary, a much greater mass of matter in others that is to be brought to rest at each change of motion.

*(To be continued.)*

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\* Specification of Patent.

**NEW WHEELED CARRIAGE.**—Mr. Law, of Kirkcudbright, the ingenious mechanist of our Dumfries Clocks, has contrived a vehicle upon an extraordinary and entirely new principle. He made the first trial of it a few days ago, in presence of the magistrates, and a number of the most respectable inhabitants of Kirkcudbright, when it met with the decided approbation of every person present. The body of the carriage was similar to a gig, with a third wheel in front; and though propelled neither by horses, steam, air, nor water, it went, even in its imperfect and unfinished state, at the rate of six miles an hour. Mr. Law having full confidence in this principle of motion, intends, we understand, to take out a patent, and has entered a caveat against any surreptitious attempts at imitation, until he completes his improvements, and enters his specification in the office of patents.—*Dumfries Journal*.

**NEW SURGICAL INSTRUMENT.**—M. Delau, jun. lately presented to the French Academy an instrument, by which he states that he can, according to circumstances, either produce in the internal ear currents of air, calculated in a great many cases to remove deafness, or occasion in the interior of that cavity a vacuum, which in other cases is not less useful. The same instrument enables him to pump water, gas, or smoke, into the ear; as also, to introduce currents of air into the lungs, and currents of water into the bladder or stomach. It may be likewise used promptly to extract from the stomach all liquids of a deleterious nature.

#### LIST OF EXPIRED PATENTS.—Continued from p. 400.

**WHEELED CARRIAGES.**—To Joseph Bramah, of Piccadilly, for improvements therein. Dated Nov. 26, 1812.

**IRON MANUFACTURE.**—To Henry Osborn, of Bordesley, Warwickshire, for a new method of welding and making various kinds of cylinders in iron and steel. Dated Nov. 28, 1812.

**CARRIAGE WHEELS.**—To T. Rogers, Esq. Dublin, for a method of constructing carriage wheels. Dated Nov. 28, 1812.

**SOLUMBRES.**—To Charles Price, of the Strand, for an improved umbrella and parasol, which he denominates "the improved Solumbra." Dated Dec. 4, 1812.

**WATCHES.**—To Samuel Smith, of Coventry, for an improved escapement for watches. Dated December 9, 1812.

**STEAM ENGINE.**—To R. W. Fox and Joel Lean, of Falmouth, for improvements in steam engines. Dated Dec. 10, 1812.

**SALT PANS.**—To John Speers, of Port Ballantrae, Ireland, for an improvement in the setting up of salt pans. Dated Dec. 14, 1812.

**EARthenWARE.**—To Joseph Hamilton, Dublin, for an improved mode of fabricating earthenwares. Dated Dec. 16, 1812.

#### TO OUR READERS AND CORRESPONDENTS.

W. W.'s. favour is received: he should shew in what respect his plan is superior to that in general use.

The Loco-motive Carriage mentioned by Mr. H. will shortly be described in this Work;—also Mr. James's.

W. P—r, and L. H. are received.

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**W. H. JAMES'S PATENT STEAM CARRIAGE.**

IN our 46th number we gave a descriptive outline of Mr. James's plan for a loco-motive carriage, the specification of the patent for which had then been just enrolled. The delay that has since taken place in putting the invention into practical operation, has been owing to the want of a *steam-generating* apparatus sufficiently portable, and adapted to such a novel purpose. That important desideratum being now accomplished by Mr. James, in his patent annular boiler, (fully described, with illustrative engravings, in our 95th number) we augur with much confidence, and no less pleasure, that in a very short time we shall see some of Mr. James's steam coaches coursing along the common roads in perfect security, and under the complete control of their guides. To these conclusions we have been led by the clear explanations kindly favoured us by Mr. James, (upon our calling upon him for that purpose) and by the inspection of his drawings. The design for the complete carriage, which has a peculiarly novel and elegant appearance, we shall publish an engraving of at our earliest opportunity, together with all the arrangements for the accommodation of passengers, the reception of the luggage, &c. Our present business is to describe the general arrangement of the machinery by which the carriage is to be propelled; and the simplicity of the contrivances for effecting or allowing of the several movements to which such a vehicle is subject, will, we doubt not, excite not only the attention but the admiration of our readers.

Instead of actuating the several wheels of a carriage with a single engine, as heretofore, Mr. James adapts separate engines to each wheel. These engines are of small and equal dimensions, and have their steam supplied by pipes connected with the boiler, situated in a convenient part of the carriage. The object of the patentee, in employing separate engines, is, that each wheel may have a motion independent of any of the other wheels, so that their powers or velocities may be varied at pleasure, which is essential in passing round curves or turning corners of the road; because, (as is well understood) when a carriage moves in the arc of a circle, the outer wheel passes over a greater distance of ground than the inner wheel—consequently rendering it necessary that the engine connected with the outer wheel should be made to work so much faster than the engine connected with the inner wheel: this Mr. James effects most completely by a very charming and exceedingly simple contrivance,—he causes the fore axletree to be connected with a stop-cock placed in the main pipe, through which the steam passes from the boiler to the respective engines; this stop-cock is so constructed, that when the fore axletree stands at right angles to the perch, (i. e. when the carriage is proceeding in a straight line) it admits *equal quantities* of steam to each engine; but whenever the axletree stands obliquely to the perch, (as in making curves in the road) it causes the stop-cock to admit *a greater quantity* of steam to the engine connected with the outer wheel, so as to cause that wheel to revolve faster, and *a diminished quantity* to the engine connected with the

inner wheel, so as to make it revolve slower, in *exact proportion* to the curve around which the carriage is moving.

Upon roads of moderate elevation, Mr. James applies separate engines to each of the hind-wheels only; but upon roads that have greater ascents, he employs four engines, that is, one to each wheel, and thus he obtains a greater degree of resistance or friction upon the surface passed over. In ordinary roads, however, Mr. James considers that two engines will be amply sufficient, because it is not required, *on this principle*, that the wheels shall be thrown out of gear, and in passing round curves they may be kept constantly in action; thus the amount of friction against the road will be preserved tolerably uniform, which is of course very important in propelling a carriage in the precise line required: if, under any circumstance, as in passing down hills, it may be advisable to lock one of the hind-wheels, it may be effected, as in other carriages, by putting on a drag.

From what we have already said, we think the advantages resulting from the employment of a separate engine to each wheel must be apparent. The next desideratum was, to give each wheel an independent rotatory motion, without the necessity of employing *fly-wheels*; this Mr. James effects by having two small cylinders to each engine (as shown in fig. 1, which we shall presently describe). Without such an arrangement, in passing over rough or loose ground, or in the ascending of steep hills, the impulse given to the carriage would not be sufficient to carry the engines over their centres.

The next object, which has hitherto been considered as one of almost insurmountable difficulty—that of putting the whole of the machinery upon springs, so as to prevent any injurious effect to the acting parts from concussions, and likewise at the same time to allow of the perfect and uniform operation of the engines upon the running wheels, when passing over rugged surfaces,—Mr. James has completely effected, by causing the engines and their frame-work to vibrate altogether upon the crank-shafts, as a centre; at the same time connecting these engines to the boiler and exit passages, by means of hollow axles moving in stuffing-boxes, which, together with the body of the carriage, is suspended upon the springs; these springs rest upon the axletrees, as will be understood by an attentive examination of the figures, (especially fig. 3) which we shall now proceed to explain.

Fig. 1 is a plan of the machinery of a carriage as applied to the hind wheels. Fig. 2 is a cross section, giving an end view of the boiler and the cranks, showing the manner in which the former is suspended, and its mode of attachment to the body of the carriage, and the situation of the springs on which it rests. Fig. 3 is a longitudinal section, giving a side view of the machinery as attached to the running wheels; similar letters of reference apply to the corresponding parts in each of the figures.

Fig. 1, *a a* represents the boiler suspended to the frame work *b b b b* above, which frame work is firmly attached to the body of the carriage, *c c c c*, and forms its support; *d d* is the axle-tree, the form of which is best seen in Fig. 2, has four supports, *e e e e*; the axles

[

of the running wheels, *ff*, are fixed thereto, and are connected in one piece, with each of the crank shafts, *gg*; by which each of the wheels are made to revolve independently of each other. Each of the engines have two cylinders, *hh*, which operate by their piston rods upon the cranks: to these separate engines steam is supplied from the boiler, *aa*, by means of the pipe *k*, which enters at the stop cock, *l*, into the steam box, *m*; from this box the steam passes into the pipes, *nn*, which move steam-tight through stuffing boxes; from thence the steam proceeds through the pipes, *ooo*, to the slide boxes, *pppp*, the slides being worked by eccentrics, *qqqq*, on the crank shafts in the usual manner, and from thence to the cylinders. - The exhaustion pipes, *rr*, lead into the hollow axles, *ss*, before described; in which there are partitions, *ss*, to separate the steam from the exit passages, which pass through the said hollow axles to the boxes, *tt*; from which there are pipes, *uu*, leading into the chimney, *v*, shown in section. The rods, *xx*, are attached to the fore axle of the running wheels, and also to the two handles of the cock, *l*, so that the fore axle and the cock move simultaneously and parallel to each other. *xx* represents part of the frame work extended for tying the engines together by means of a connecting bolt; and so as to allow the body of the carriage to have a slight lateral motion upon its springs, independent of the engines, by means of the hollow axles sliding longitudinally through the stuffing-boxes.

In the preceding account we have given the substance of Mr. James's specification; and although it contains much novel and valuable matter, he limits his claim of patent right to the following points only, which we add verbatim:—

"I have herein described, for the perfect understanding of my invention, the general construction and operation of a steam carriage to be actuated upon my improved principles; but I do not mean to confine myself to this particular construction or adaptation of parts; as my invention consists simply and exclusively in adapting distinct steam engines to the several wheels upon which the carriage runs, for the purpose of actuating such several wheels independent of each other, whatever may be the number of wheels so employed, or whatever may be the construction or position of the steam engines and their appendages so adapted, or whatever may be the form of the carriage to be propelled."

**EXPIRED PATENT GRANTED TO CHARLES RANDOM DE BERENGER, ESQ. OF PALL MALL, FOR CERTAIN MEANS OF PRODUCING A VALUABLE OIL, AND ALSO SOAP AND BARILLA, AND A BLACK PIGMENT.**

From reading the title of this patent, it appears to relate to an important discovery: from the various concerns in which the ingenious patentee has since been engaged, it seems to us also as a very probable circumstance that the matter has never been fairly tried, or its merits ascertained. The patent privilege is, however; just *expired*, so that any body is at liberty to prepare the products in question according to the patentee's process. At all events, as there appears sufficient inducement to investigate the subject further; we annex the information contained in the enrolled specification, which states that—

“The invention consists in producing a valuable oil, as also, soap and barilla, and a black colour or pigment, from the plants known by the name of *euphorbias*; and although all the different *euphorbias* can be made to produce the above, the *euphorbia lathyris* is preferable to the others, being the most productive. The ripe seeds or fruit are to be collected, and subjected to the operation of the usual oil press, when ‘a very superior oil’ is obtained for a variety of domestic purposes. The pulp or dregs remaining after the oil has been pressed may be made into soap, by adding and mixing barilla and a little of the oil (above alluded to) to it, to which animal fat or grease, at pleasure, may or may not be added. The stalk, branches, leaves, and other parts of the *euphorbias*, burnt, produce also a kind of barilla; and to obtain the black colour or pigment the dregs or pulp (formed of the pressed seeds) must be burnt in a crucible, watching it carefully to ascertain its perfection in the customary way of obtaining pigments by burning.”

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**A NEW AND SIMPLE MECHANICAL METHOD OF OBTAINING THE AREAS OF CIRCLES AND CONTENTS OF CYLINDRICAL BODIES AND MEASURES.**

(Communicated by the Author.)

THE Method about to be described does not require any calculation, and consequently will be a great saving of time and trouble, besides enabling those who may be entirely unacquainted with decimals or fractions to obtain a result equally as accurate as by the use of calculation; it being only necessary to obtain the diameter of the circular surface or cylinder; and this is done by taking the measure from a common rule, on which are to be placed numbers representing the areas of circles of various diameters (by means of a rule to be divided) as hereafter will be mentioned.

*Example.*—Suppose you have a circle to find the area of, instead of taking the diameter in inches, you take it on the edge of the rule, which gives the area at once. Suppose it to be three inches and two-tenths in diameter, the rule will give you the area eight square

inches: now if this number be multiplied by the length of a cylinder, it will give the contents. Let us see what preference this mode has over the ordinary one, and this will be best ascertained by working the former example; first the diameter, three inches and two-tenths, must be squared, (that is, multiplied into itself, and as this is a decimal, the person is required to understand this department of arithmetic), the product is equal 10,24 in.; this product must next be multiplied by the constant decimal ,7854 (the proportion of a circle to a square of the same diameter) which gives us 8 square inches as the area: and if it be a cylinder, it must be multiplied by the length as before. I shall now add a table of diameters when the areas are whole numbers, which may be placed on the edge of any rule, and will then give the areas of any circle you may require; they are calculated the reverse of the common mode just described, to obtain the area by the diameter of the circle:—

| Inches.<br>Area. |   | Inches.<br>Diameter. | Inches.<br>Area. |   | Inches.<br>Diameter. |
|------------------|---|----------------------|------------------|---|----------------------|
| 1                | = | 1.128                | 10               | = | 3.569                |
| 2                | = | 1.604                | 20               | = | 5.074                |
| 3                | = | 1.954                | 30               | = | 6.181                |
| 4                | = | 2.257                | 40               | = | 7.067                |
| 5                | = | 2.537                | 50               | = | 7.989                |
| 6                | = | 2.764                | 60               | = | 8.742                |
| 7                | = | 2.986                | 70               | = | 9.443                |
| 8                | = | 3.209                | 80               | = | 10.094               |
| 9                | = | 3.385                | 90               | = | 10.707               |
|                  |   | Area.                |                  |   | Diameter.            |
|                  |   | 100                  | =                |   | 11.008               |

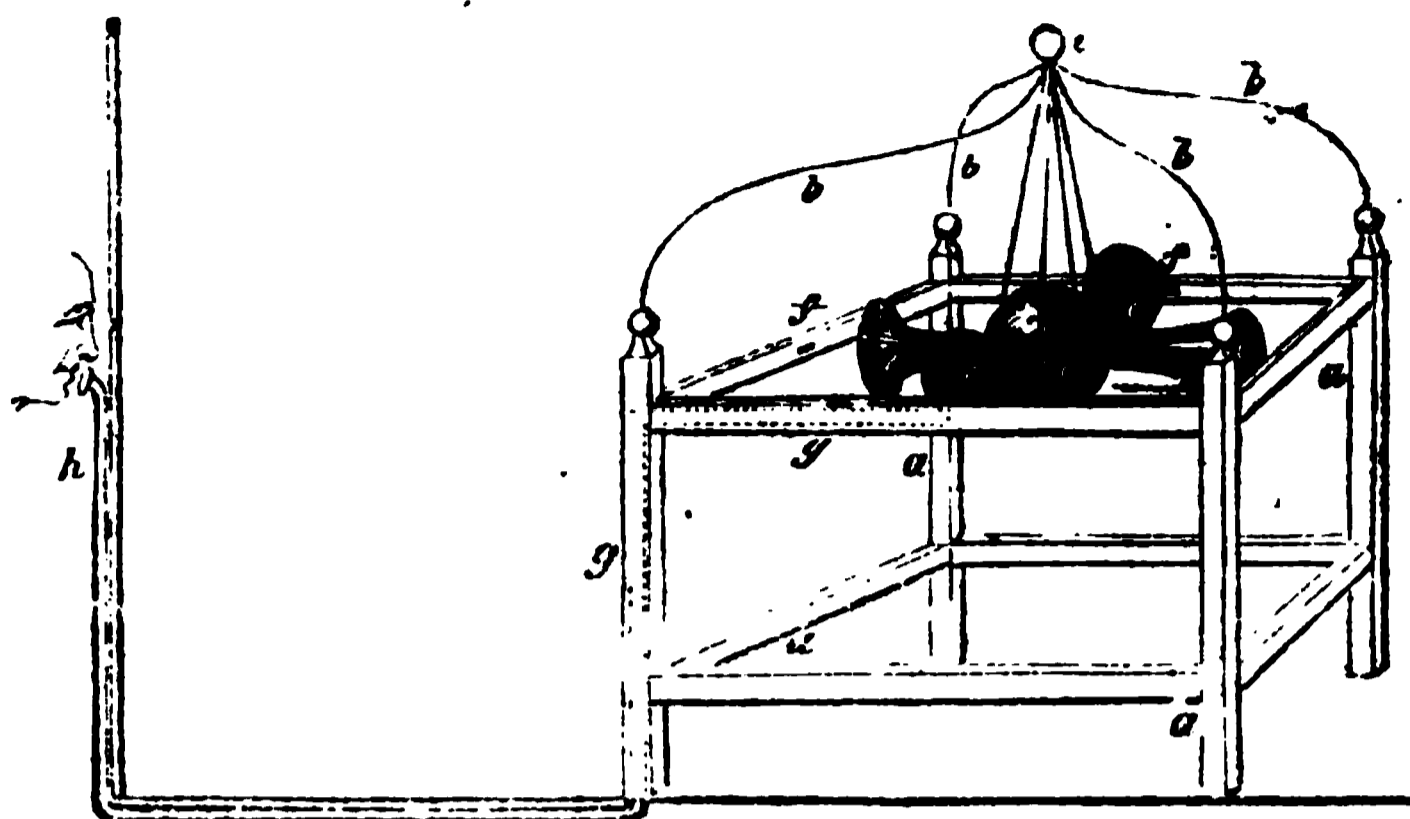
18, Picket Street, Strand.

A. PRITCHARD.

### London Mechanics' Institution.

ON Wednesday, the 5th instant, Professor Millington completed his course of Lectures on Pneumatics, at this Institution. The last lecture was principally devoted to Acoustics, in which the lecturer took an opportunity of introducing and explaining that ingenious deception called the Invisible Girl.

The apparatus consisted of a rectangular frame as represented in the annexed figure at *aaaa*; from the spherical tops of the four corner posts, proceeded as many curved brass wires *bbbb*, the upper extremities of which centred in a gilt ball *c*; to this part, was suspended by ribbons, a large hollow sphere *d*, made of thin copper, having four trumpets *eeee*, (of the same metal) fixed into it at equal distances, and at right angles with each other. The trumpets were suspended in such a position, that each of them was presented opposite to a small mortice hole, as shewn at *ff*, of which there was one in each of the four uppermost horizontal rails. Inside of these rails was concealed a small metallic tube, with apertures in it, answering to the mortice holes *ff*; this tube was continued down the interior of one of the corner posts, as represented in dotted lines at *gg*, then passed under the floor, and carried into an adjoining apartment



*h*, where the invisible lady was placed to answer questions proposed to her through the medium of the trumpets; these being suspended as represented, appear to cut off all communication, the sound being conveyed through the tubes, which are wholly hidden from view. In the original apparatus employed at Leicester Square, where the invisible girl was publicly *heard* (not exhibited), the ear, or mouth, of the trumpet was expanded, so as to form of itself a small apartment or case, sufficiently large for the reception of a young woman and a piano-forte, upon which she occasionally played; and an aperture was made in the wall horizontally between two picture frames, which being dark and glazed over, was not discoverable to the company, while she could see and comment upon the dress and proceedings of her visitors. The deception was very complete, and formed a highly amusing acoustic experiment. The young woman employed as the confederate, was a person of good taste and education; she sung and played well, and replied to questions with great propriety, in English, French, and Italian.

At the conclusion of the Lecture, it was announced that Mr. Kirby would commence a course of three Lectures on the Steam Engine, on Wednesday the 11th instant, and that the commencement of *Dr. Birkbeck's Anatomical* course had been unavoidably deferred till the 27th of this month. We understand that the Theatre will be closed in Easter Week, for the purpose of being painted; and that Mr. Kirby's second Lecture will be delivered on the 25th.

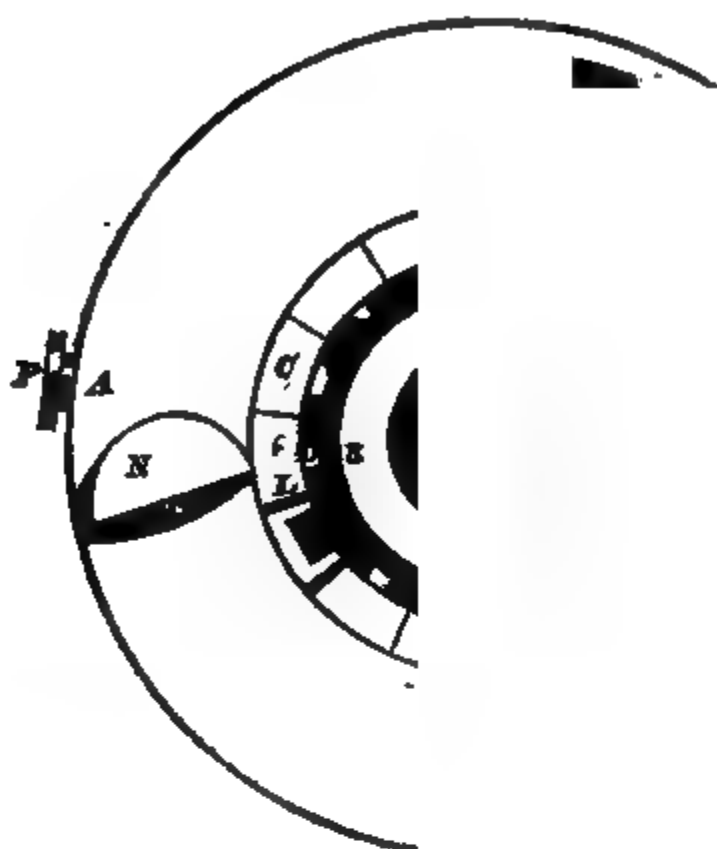
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## History of the Steam Engine, Chap. VI.

*Continued from p. 415:*

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Mr. Samuel Clegg, of Manchester, obtained a patent for a Rotative Engine in the year 1800, the principle of which is thus explained.



" Fig. 1 is the underside of a circular piece of cast iron, and of a diameter and thickness proportioned to the size of the engine. I is the common centre of the different circles shown on this piece. With any convenient radius less than that of A A describe the circle C C, and within the latter the circles D D and E E,—the radius of the latter being the least of those now named. From the uses of these parts, which will be immediately described, an idea of their relative dimensions will readily be inferred. Let that part of the surface A B, A B which is contained between the circles A and C, be plain. Between the circles C and D sink a circular groove C D of any given depth; and between the circles D and E let another circular groove be cut of the breadth D E, and of any given depth less than that of the groove C D. Let the remaining part of the surface A B, namely, that included between E and B, be cut down to any depth less than the depth of the groove D E.

" Into the groove C D let such a number of segments of a circle be fitted as shall form a complete circle, excepting the space at L, which is occupied by adjusting screws or springs, to keep the segments close together. The segments are the breadth (or nearly) of the groove C D, and of a depth less than the depth of the groove C D. Those sides of them which apply to each other are to be ground together plain, and air-tight if possible. Their under surfaces, which are shown in Fig. 1, are to be flat, so that the whole may form one complete plain surface, excepting the space before mentioned, which is taken up by adjusting screws or springs I, which screws or springs are placed so far below the surface as to let a roller pass by them, which will be mentioned hereafter.

" Fig. 2 represents a vertical section of the plate and grooves of

Fig. 1, resting upon a circular chamber or hollow space  $Y Y$ , in which chamber the said plate forms a light covering, excepting that space occupied by springs or screws  $L L$ , as before mentioned. In the centre of all the grooves and circles before described, is also the centre of the shaft. On the shaft  $I$  is fastened a plate or coupling  $Z$ , in which is inserted a bar  $F$ : this bar may be of any given breadth, but in depth must be less than the depth to which the circle  $E B$  was cut below the surface  $A B$ ; to this bar is attached a wheel or roller  $G$ , shown in Fig. 3, upon a larger scale. The manner in which it is attached to the bar  $F$  is also there seen, and it is so attached to it that the top of the wheel or roller  $G$  shall always be higher than the top of the bar  $F$ . The wheel  $G$ , being attached to the bar  $F$ , will, when the bar is made to revolve, describe a circular path  $H H H$  along the plain surface of the segments, before described. Let that portion of the plain surface of each segment which answers to the path of the roller  $G$  be rounded off, in such a manner as to

make that portion of the surface an arc of a circle, the convex circumference of which is presented to the roller  $G$ . In Fig. 3, at  $H$ , is shown a perpendicular view of one of the segments, rounded off in the manner described, and presenting its convex circumference to the roller  $G$ . There may, likewise, be another roller attached to the bar behind it, to lower down the segments in the same manner in which they are raised by the first roller. Now it is obvious, all the said segments being in their places in the groove  $C D$ , Fig. 1, that the roller  $G$ , in performing a revolution round the centre  $I$ , must travel along a series of convex arcs of circles, equal in number to the number of segments in the groove  $C D$ . The groove  $D E$  is, in fact, a recess in the deeper groove  $C D$ , and may, if necessary, be filled with hemp or tallow, or any other material which may answer the purpose intended.

“It must be remembered that Fig. 1 is a view of the underside of the machinery. Fig. 2 is a section of it, supposed to be in its proper position, resting as a cover to the circular chamber  $Y Y$ , and the segments resting upon a flat facing  $O O$ . Each segment projects over the facing  $O O$  on both sides; their projection on one side completes the cover over the hollow chamber, and the other is the rounded surface for the roller to lift them. The facing  $O O$  is exactly or as nearly as can be, level with the underside of the plate  $A B A B$ , when the plate is on its place, as represented in Fig. 2; so that when the segments are all in their places, they complete the semi-

circular chamber, and fit so close on their seats and in the groove, that were the chamber to be filled with any elastic fluid, they would prevent its escape, or nearly, excepting where the space is left for the springs or adjusting screws. The use of these segments, *which are what the patentee claims as his invention*, is as follows: conceive a door or valve to be fitted in the hollow chamber at Q, and a piston R, likewise fitted in the chamber so as to move round in it, and the bar F made fast to the piston, on the side and in the manner represented in Fig. 1; then, if an elastic fluid of sufficient strength enters the chamber at N, it will press equally against the door or valve, and the piston; but the door or valve being immoveable, and the piston moveable, the piston will be propelled forward in the circular chamber by the elastic fluid. The bar F being fastened to the piston, and the roller G to the bar F, in the manner represented in Fig. 3, and the roller being in motion with the bar and piston, the roller will lift the segments in succession, as it comes in contact with them.

The segments before the bar, being by this means lifted, allow the bar to pass, and the operation being the same in all, the bar and piston make a complete revolution. Each segment, as soon as the bar leaves it, falls down by its own gravity, or by springs, or any other contrivance, so that the opening which is made for the bar to pass is closed before the elastic fluid reaches it; the elastic fluid being kept from the opening by the inner breadth of the piston exceeding the outer diameter of each segment. The door or valve is lifted out of the way of the piston, when the piston comes in contact with it, into the opening in the plate at N, a recess being made in that segment which is opposite the door for that purpose; during which time the elastic fluid is shut out, but it enters again when the door returns to its seat, and thus the operation continues.

"In Fig. 2 C is the condensing vessel, *a* the air pump, *b* the air pump buckets, *d* the hot water cistern, *e* the clack. *ff*, the inclined plane for working the air pump bucket, is fastened in the shaft, and consequently revolves with it. To the air pump bucket is attached a hollow tube through which the shaft goes. To this tube is fastened a cross bar, at each end of which is a roller *r*, resting upon the inclined plane: of course when the plane revolves the bucket rises and falls. The plane is divided into two different angles, so as to make it more acute where the bucket rises, but nearly an angle of  $45^{\circ}$  where the bucket descends, as represented in the drawing. The injection enters the groove above the blocks, and keeps about three inches of water upon them: the injection then enters the condenser out of the groove, as seen at X. Each segment or block, K, is of sufficient weight to resist the pressure against that part of their under surface which is over the semi-circular chamber, and will generally be about five-eighths of an inch. The blocks may be likewise lifted exactly in their centre of gravity by means of a lever in the upper part of the groove, and worked by a roller or small inclined plane fastened to the shaft, as represented by the dotted lines; and as it is not necessary for the blocks to rise more than half an inch or five-eighths, the motion will be very easy; and whatever descending power the blocks have, they will propel the bar forwards proportioned to their weight and the space through which they move, so that there is only the friction of the blocks to overcome. Supposing the pressure on the piston to be 800 lbs. the weight of all the blocks will be about 500 lbs. for such a sized piston, and will seldom exceed more for the largest engines, as the space for the bar to pass will be nearly the same in all, the strength of the bar depending upon its breadth, not on its thickness: thus, 800 lbs. will move through the space of 16 feet, whilst 500 lbs. go through the space of half an inch: then, if the descending of the blocks is taken into consideration, as before described, the friction of the blocks will make no sensible difference to the progress of the piston. The lid M being the only opening into the engine, and the only stuffing-box, and that covered with water, no air can enter but what is contained in the water used for injection."\*

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\* Specification of Patent.

It is our opinion that this patent would never have existed had Mr. Clegg been acquainted with the effects of steam acting on a lever as explained at page 43. It is there shown that no increase of effect is gained by increasing the length of the lever; for although steam of a given pressure acts on a lever of two feet from the fulcrum with twice the effect it does on a lever of one foot, yet it is apparent that the consumption of steam is also doubled, and, therefore, that the power is as the steam consumed. Though it is presumed that this fact is too well known to need minute explanation, yet it is necessary now to mention it, since there can be little doubt but that if Mr. Clegg had been aware of it, he never would have made use of those segments which alone constitute his patent; the purpose of such segments being (as has been explained) to obtain the effect of the steam in a channel at some distance from the centre of motion, without making use of the interior cylinder or plate, used in most of such engines.

No advantage, therefore, arises from the use of these segments, but, on the contrary, the extreme nicety of their fitting is a considerable drawback; and we apprehend also, that they would soon become deranged, and suffer the steam to escape. But the most objectionable part is the valve which has to be struck out of its place, whilst the piston is travelling at its full speed; indeed, there can be little doubt but that the rapid destruction of this valve was the cause of failure.

Mr. William Chapman's Rotative Engine, patented 1810, is represented by the accompanying drawing.

A represents a drum, packed on its two ends, and revolving within an exterior cylinder C C, so that a channel is formed between the two cylinders, in which the steam acts upon the flaps F G. I is a cavity filled with hemp, which effectually stops up the passage or channel; an adjusting screw K tightens up the packing as it wears; D is the steam pipe, and E the escape pipe. The steam being introduced at D presses upon the valve or flap F, which recedes from the pressure, until the valve G having reached the roller H, is shut into the cavity L, and passes under the stop I. As soon as it has cleared the stop, a pin on the outside strikes a lever attached to the spindle on which the flap is hung, opening it out again as before, so that it fills up the passage and receives the action of the steam, allowing F to be shut at the proper place, without interrupting the revolution of the axle. More explanation is unnecessary, as the drawing fully shows the plan.

An engine on this principle was tried at the iron works of Messrs. Hawks & Co. Gateshead, but so great was the noise made by the flaps striking the roller, that many of the workmen who heard it imagined the sounds to proceed from a tilt hammer. It was also found impossible to keep it steam tight, by the greatest attention to the packing. Another engine of larger dimensions was also tried on the Tyne, but finally abandoned for the same reasons.

Mr. Richard Witty, of Hull, procured a patent in 1810, for an engine, the revolution of which was effected by weights being alternately drawn to and driven from a centre, round which a working cylinder or cylinders revolved, there being attached to the piston rod or rods a number of weights. These weights were drawn as near as possible to the centre on the ascending side, and are projected outwards on the descending side as far as possible from the axis.

In the following year Mr. Witty took out a second patent for improvements on the former plan, which improvements consisted in making the piston draw or force round the machinery, whilst itself moved both in a rectilinear and rotatory motion in a cylinder; which revolved upon an axis. The mechanical contrivances by which this was effected were of various kinds, which caused the power of the piston to draw or force the cylinder round.

[Our author then proceeds to describe several of these contrivances, that are well-deserving of notice from their ingenuity, for which we must refer our readers to Mr. Galloway's separate History of the Steam Engine, pp. 151—4.]

The Rotative Engine of Mr. Onions, of Bristol, patented 1812, differs essentially from all we have described. The invention consists of an annulus or hollow ring connected by hollow arms, with a revolving shaft also hollow. The steam is admitted at one end of this shaft, passes through one of the arms, and thereby gets into the rim in which are valves so placed as to prevent the steam from acting in more than one direction. The annulus is nearly half filled with a metallic alloy composed of eight parts of bismuth, five of lead, and one of quicksilver. The property of this alloy is, that although solid at the common temperature of the atmosphere, it becomes fluid in

boiling water or steam. The steam, therefore, when introduced into the wheel after first fusing the alloy, forces it up on one side of the wheel, thereby making it heavier than the other: the metal, in attempting to regain its equilibrium, causes the wheel to revolve; and the supply of steam being continued the revolution is kept up. For a more perfect comprehension of this machine our readers may inspect the drawing we have given of Watt's Rotative Engine, at page 47, where the operation of the valves, and entrance and escape of the steam, are effected in a somewhat similar manner. The machines in fact will be nearly the same, if we suppose Mr. Watt's weight to be a fluid instead of a solid one.

A singular mishap befel this machine on its first trial. It is a property of bismuth that, like water, it expands as it crystallizes or becomes solid, so that, on the morning succeeding its trial, the engine was found broken or rather burst into small fragments, owing to the expansion of the alloy. This result, therefore, proved that in order to preserve the engine, it was necessary either to keep it constantly hot, or to remove the metal before it became solid; either of which would be a sufficient objection to its adoption. But there are besides, other difficulties to contend with in this kind of engine, which we shall notice in our remarks on Masterman's Steam Wheel.

*(To be continued.)*

### **Discoveries & Processes in the Useful Arts.**

**IMPROVED MODE OF ETCHING ON IVORY.**—The usual mode of ornamenting ivory in black, is to engrave the pattern or design and then to fill up the cavities thus produced with hard black varnish. The demand for engraved ivory in ornamental inlaying, and for other purposes is considerable, although the price paid for it is not such as to encourage artists of much ability to devote themselves to this work, which consequently is trivial in design and coarse in execution. Mr. Cathery's improvement consists in covering the ivory with engravers' varnish, and drawing the design with an etching needle; he then pours on a menstruum composed of 120 grains of fine silver, dissolved in one ounce measure of nitric acid, and then diluted with one quart of pure distilled water. After half an hour, more or less, according to the required depth of tint, the liquor is to be poured off, and the surface is to be washed with distilled water, and dried with blotting paper; it is then to be exposed to the light for an hour, after which the varnish may be removed by oil of turpentine. The design will now appear permanently impressed upon the ivory, and of a black or brownish colour, which will come to its full tint after the exposure of a day or two to the light.

The property which nitrate of silver possesses, of giving a permanent dark stain to ivory and many other substances has been long known; but Mr. Cathery has the merit of having advantageously applied it in a department of art in which it is likely to be of considerable service by improving the quality of the ornament, and at the same time of diminishing the cost. Varieties of colour may likewise be given by substituting the salts of gold, platina, copper, &c.

for the solution of silver. Mr. Cathery (of N<sup>o</sup>. 6, Hyde Street, Bloomsbury) was presented to the Society of Arts for the communication of this process of Etching on Ivory.

**PREPARATION OF OXIDE OF CHROME, AS A PIGMENT.**—M. Nape recommends that a chromate of mercury should be formed, according to the usual process, by precipitation from a chromate of potash and a nitrate of mercury, as neutral and concentrated as possible. The oxide of chrome, obtained by heating the chromate of mercury, will have the greatest perfection of colour if it be put into an unglazed porcelain crucible, and exposed to the heat of the furnace during the time required for baking the porcelain. The oxide produced will have a fine grass green colour.

The following directions are given for the preparation of the blue oxide:—The concentrated alkaline solution of chrome is to be saturated with weak sulphuric acid, and then to every 8 lbs. is to be added 1 lb. of common salt, and  $\frac{1}{2}$  lb. of concentrated sulphuric acid; the liquid will then acquire a green colour. To be certain that the yellow colour is totally destroyed, a small quantity of the liquor is to have potash added to it, and filtered; if the fluid is still yellow, a fresh portion of salt and of sulphuric acid is to be added: the fluid is then to be evaporated to dryness, re-dissolved and filtered; the oxide of chrome is then to be precipitated by caustic potash. It will be of a greenish-blue colour, and being washed must be collected upon a filter.—*Bull. Univ. Brande's Journal.*

**CULTURE OF CARDAMOM.**—A number of experiments have recently been made by an Italian naturalist, on the culture of Cardamom, (bastard saffron) with the double object of obtaining the colouring matter of the petals, and the valuable oil yielded by its seed. It appears that the indigenous is not in any way inferior to the exotic cardamom.

**ROTARY LAMP.**—At a late meeting of the Royal Institution an ornamental lamp, constructed by Mr. Bartholomew, was placed upon the library table. Some very elegant paintings and spiral devices were kept in constant rotary motion by the action of a current of heated air, issuing from the top of the chimney of the lamp. The contrivance appears to be well adapted to a number of purposes of ornamental illumination.

**METHOD OF DESTROYING THE EMPYREUMATIC ODOUR OF ALCOHOL, BY DR. WIRTING.**—The purification of alcohol by chloride of lime is not expensive. The action is chemical, and analogous to that of bleaching; the empyreumatic parts are entirely destroyed. The following is the manner in which it has been employed: two ounces of the chloride were mixed with spirit into a uniform clear fluid, which was then put into a distillatory apparatus, with 150 measures of spirit; all the joints were then luted, and the distillation commenced. The first measure of product had a slight odour of chlorine, and was preserved apart for rectification; the rest of the produce was perfectly pure. The chloride made use of should, when dissolved in 26 parts of water, bleach vegetable colour with which it may be mixed.—*Bull. Univ.*

**PRESERVATION OF SKINS.**—I. Hegar, a tanner, at Tyman, in Hungary, uses with great advantage the pyroligneous acid, in preserving skins from putrefaction, and in recovering them when attacked. They are deprived of none of their useful qualities, if covered by means of a brush with the acid, which they absorb very readily.

**METHOD OF FORCING RHUBARB FOR TARTS.**—At a meeting of the Horticultural Society in March last, a paper from the Society's gardener was read, upon the best method of forcing Rhubarb for tarts, and fine specimens of the leaves, forced in the manner described, were placed upon the table. The method was simply this: the seed is sown in a rich border, in the first week in April; the young plants are kept thin and clean during the summer, and before the growing season is fully over, they are taken up, put into common forcing pots, three in each, and placed in a shaded border till they are wanted. In January or February they are put in the forcing house, and submitted to a very gentle heat. This is the most simple, effectual, and certain mode of forcing rhubarb yet known.

#### LIST OF EXPIRED PATENTS.—*Continued from p. 416.*

**CARPETS.**—To John Hanbury, sen. of Bartlett's Buildings, Holborn, for an improved method of weaving Kidderminster Carpeting. Dated Dec. 19, 1812.

**CRANES, &c.**—To Thomas Rogers, Esq. of Dublin, for a method of applying manual power to the crane, pile driver, and other machinery. Dated Dec. 19, 1812.

**SMOKE CONDUCTOR.**—To John Fisher of Oundle, Northampton, for a smoke conductor. Dated Dec. 19, 1812.

**FOUR WHEELED CARRIAGES.**—To George Heffer, of Lambeth, Coach Maker, for an improved construction of 4 wheeled carriages. Dated Dec. 19, 1812.

**NEW POWER.**—Dr. John Morgan, of Dublin, for a new power applicable to the propelling of boats, &c. Dated Dec. 19, 1812.

**SECURITY FROM DROWNING.**—To J. S. Eschancier, of Gibraltar, and H. C. Jennings, of London, for a new mode of manufacturing, using and applying certain articles, by means of which, mariners and other persons may be saved from drowning. Dated Dec. 19, 1812.

**SMEETING.**—To John Lewis, of Llanelli, Carmarthen, for certain improvements in the art of smelting copper ore. Dated Dec. 19, 1812.

**SURGICAL INSTRUMENT.**—To John Barber, of Portsmouth, for an instrument to prevent the hemorrhage of the subclavian artery safely, in cases when necessary to amputate the arm from the shoulder joint. Dated Dec. 21, 1812.

#### TO OUR READERS AND CORRESPONDENTS.

Mr. Davey's paper and drawing has been received, and is intended for insertion in our next.

The communication mentioned by R. D——n, has never reached us; probably it was wrongly directed, and has got into other hands, which we are led to suppose, from the erroneous superscription of his present favour.

Tipton Mechanic is not forgotten: want of success in obtaining the subject of the inventor has caused the delay. The book, or the extract in question, shall be sent in a few days to T. M., Post-office, Dudley.

R. I——g is informed that we purpose giving a particular description of Mr. Machell's improved new patent lamp in an early subsequent number.

H. L. and W. S. are unavoidably postponed

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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## PERKINS'S NEW "HIGH PRESSURE SAFETY ENGINE."

*To the Editor.*

SIR,

Presuming that a brief description of Mr. Perkins's New "High Pressure Safety Engine," may, in the absence of a more amplified and particular account, be acceptable to your readers, I venture to send you the enclosed. It has been drawn up perhaps with too little regard to the arrangement and construction of the subordinate parts; but to have done full justice to the genius of the inventor in these respects, several drawings would have been necessary, and a more detailed description. I am anxious therefore that it should be clearly understood, that I only profess to give a correct account of the principle and mode of action of the engine, and with that intention the accompanying diagram (see the preceding engraving), is contrived to shew the whole operation at one view.

*Reference to Engraving.*—*a* is the working cylinder, supplied with steam by the valve *b*; this valve, by means of an intermediate lever *c*, is operated upon by the revolution of the cam *d*, on the main shaft *e*. *f* is the piston, *g* the piston rod, *h* the connecting rod to the crank *i*; *l l l* bearings in which the shaft turns. *m* is an eccentric, which works a valve placed in the injection tube, leading into the condenser *n*; the lower extremity of the condenser is formed into a box, having two valves, opening outwards into the expansion vessel *o*, to which a pipe, *q*, is connected, leading into the hot well *p*; in this is placed a force-pump *t*, worked by a rod attached to the crank *v*, which forces the condensed water (temperature about 100°), through the pipe *u*, into the generators *w w*, fixed across the furnace and through the opposite walls: *x* is a lower and third tier of pipes, similar to the others, but employed to allow the water from the former to expand into steam, after it has required sufficient power to overcome the pressure of a heavily loaded valve. From the pipes *x*, the steam passes into the large vertical chamber *y*, and from thence, at regular intervals, along the pipe *z* into the working cylinder. The separate figure J, shews one of the pipes, the same as those, *w* and *x*, in perspective.

From the foregoing, it will have been noticed that this engine has only what is termed a single action, the steam being admitted on one side of the piston only; and that *the principle* of heating water in very strong vessels under a high state of pressure, as in Mr. Perkins's former patent, is still adhered to. The pipes for heating the water, *w w*, and those for allowing it to expand into steam, *x*, are formed of cast iron bars, four inches square, with a perforation throughout their length of 1½ inch in diameter. These are arranged in three horizontal tiers over the furnace, in such manner that the heat shall act successively, and as uniformly as possible, upon their surfaces: they are connected at their extremities so as to form one continuous vessel, by bent tubes screwed into their orifices, which are further secured by bolts and flanges, as represented in the diagram.

The two uppermost rows are kept filled with water, at a very high temperature under a heavily loaded valve, which communicates with the lowermost tier of tubes; into these the heated water is injected (at every stroke of the pump), and instantly flashes into steam; the steam thus formed, has to pass successively through every pipe in the lowermost range, exposed to the strongest action of the fire; from the last of them it enters, by a short tube, the large vertical chamber *y*, for the supply of the engine.

The internal diameter of the principal portion of the cylinder is about eight inches,\* but the lower end is enlarged into a cylindrical chamber of nine or ten inches in diameter, and about six inches deep, for the reception of the piston at the end of the stroke, which takes a range of about 20 inches. The steam is admitted into the top of the cylinder at a pressure of 800 lbs. upon the square inch, and when the piston has descended through one eighth of the length of the cylinder, the supply is cut off, so that the remainder of the stroke is effected solely by the expansion of the steam; when the piston has reached the bottom or enlarged part of the cylinder, the steam rushes past it through the condenser into the expansion vessel, when the whole of it expands to the atmospheric pressure: the valves at the lower part of the condenser (before mentioned), now close by their own gravity, at which instant a spray of water is injected into the condenser, by which the remaining steam is condensed; and nearly a perfect vacuum effected. The water thus reproduced, is blown into the expansion vessel, along with the steam, at the next down-stroke of the piston; the water running down into the hot well, to be returned to the generators by the action of the force-pump, while the steam escapes by a lateral tube into the chimney of the furnace. The upward or return stroke of the piston is effected by the momentum given to the fly-wheel, and to prevent any resistance to the ascent of the piston, which might be caused by condensed steam above it, there is a small valve in the piston, which is opened when the latter reaches the bottom of the cylinder; therefore, whatever uncondensed steam may remain in the cylinder above the piston, has free passage through the latter to the underside, thus occasioning no obstacle to its ascent. At the termination of the upward stroke of the piston, this little valve is closed, in like manner, by striking against the top of the cylinder, so that the next charge of steam introduced into the cylinder may not be diminished in its effect.

The piston employed is of the metallic kind, and consists of several expanding rings, formed of a *peculiar alloy*, which Mr. Perkins states he has found to require neither oil, tallow, nor any lubricating material whatever, to reduce the friction; on the contrary, by the working of the engine, the rubbing surfaces of the piston and cylinder become so highly polished, as to reduce the friction considerably below that of the ordinary metallic packing when oiled. Thus Mr. Perkins has obviated one of the principal difficulties he had to

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\* That at present on Mr. Perkins's premises in Water Lane, Fleet Street, which is at work, and open to public inspection every Saturday.

contend with, namely, that of the oil or grease becoming carbonized, when working with steam of such high temperatures as he employs.

Among the advantages resulting from these novel arrangements, the ingenious patentee calculates that he saves full half the fuel usually employed; that by the mode of condensing the steam, he effects as perfect a vacuum as in Bolton and Watt's condensing engines, with a great saving in the consumption of water, and without the necessity of, or the friction attending, an air-pump.

Some exception has been taken to Mr. Perkins's mode of showing the power of his engine by a weighted lever resting on the upper edge of the periphery of his fly wheel, a method involving so much uncertainty that I cannot believe it possible a man of Mr. Perkins's great talents can propose it as a correct test, but only as a convenient means of subjecting the engine to considerable labour by way of proving its power to a certain extent.

Your constant Reader,

M. K.

*[Since the foregoing was prepared for the press we have been favoured with some excellent drawings of Mr. Perkins's New Engine and Generating Apparatus, made by Mr. Davy, from actual measurement; consequently embracing all the details in their true proportions, many of which are highly ingenious and interesting. The drawings being already in the hands of our engraver, we shall be enabled to present them to our readers in the next number, with full explanations.]*

—EDITOR.

## IMPROVED MINERS' SAFETY LAMP,

By MR. J. ROBERTS, OF ST. HELEN'S, LANCASHIRE.

THE only real objection to the use of Sir H. Davy's Safe Lamp for coal miners, is the inferior degree of light it gives when compared with that given by a naked candle. This arises from two causes, namely, the necessary obstruction offered by the black wire of which the cage or gauze is composed within which the lamp is placed, and the casual obstruction occasioned by the adhesion of smoke to the inside of the cage when the lamp is not carefully trimmed, and of smut and dust to the outside of the cage.

To diminish the obscuration occasioned by the first cause, Mr. Roberts proposes that the wire shall be kept bright and polished, by cleaning the cage every night with a soft brush, and the black powder or smut which occurs in all coal mines, especially in the neighbourhood of faults, this smut is pulverulent non-bituminous coal, sufficiently hard to remove the rust from the surface of the wire, without materially wearing the wire itself.

As the lamp is at present constructed, the oil will run out of the cup or receptacle in which it is placed, if the lamp is laid in a horizontal position, an accident which frequently occurs on account of the lamp being rather top heavy. When this happens the gauze becomes smeared over with viscid oil, which causes the coal dust

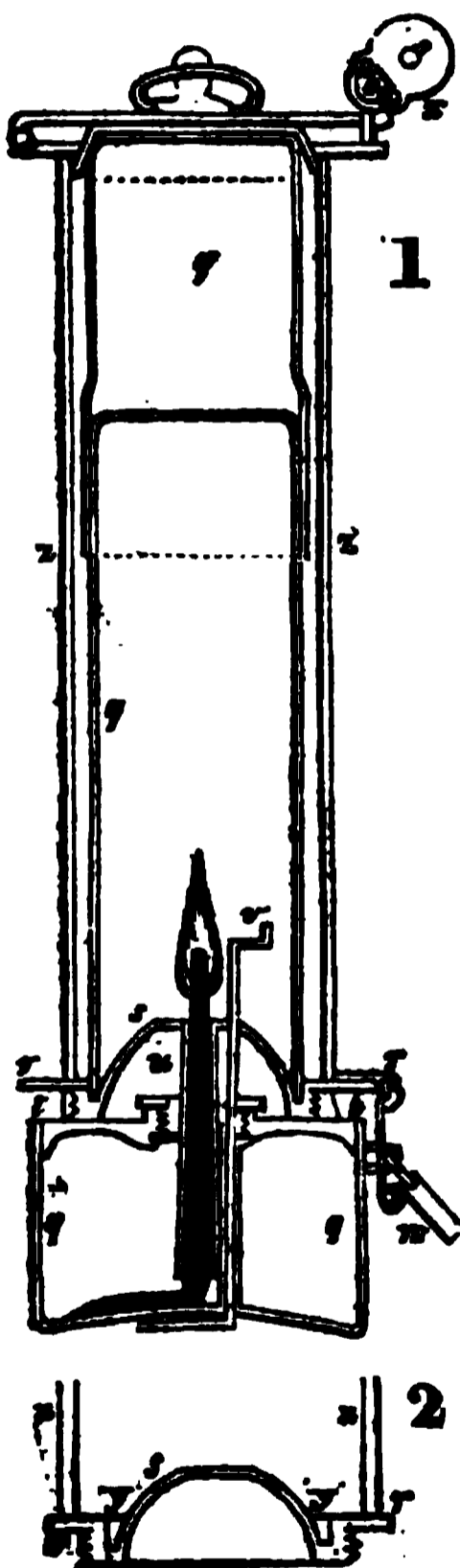
floating in the air of the mine to adhere to it, and in a short time to fill up, more or less, the meshes of the gauze. By merely shaking or tapping the lamp the dust will not be dislodged; and if the miner attempts to clear his lamp by blowing through the wire gauze, he runs the risk of putting out the light, and after all very imperfectly clears the meshes; there is also, perhaps, some risk of forcing the flame through the meshes on the opposite side, and of producing an explosion, if the surrounding air is inflammable.

In Mr. Roberts's lamp the overflow of the oil is impossible, on account of the dome-shaped cover which surrounds the wick; the dust, therefore, that settles on the gauze may be dislodged by a mere tap of the finger, or, what would perhaps be better, by the application of a small brush similar to that which soldiers carry to clear the pan of their muskets, and which might be attached by a bit of small chain to the handle of the lamp.

Fig. 1 represents a section of the lamp *pp*, and wire gauze *qq*; *rr* a screwed cap, with a hollow dome *s*; it screws into the neck, *tt*, of the lamp; the dome rises a little above the wick holder *u*, having an opening at top to let the wick and trimming wire *v* rise through. This dome serves to catch and retain any oil that may spill by shaking the lamp, or knocking it over, thereby protecting the wire gauze *q* from being smeared; *w* and *x* two locks, the former to secure the cap *g*, and the latter to secure the wire gauze *q* from being removed.

Fig. 2 a section of the cap and dome, *rrs*, separate from the lamp; the wire gauze fits into the cavity *yy*, around the dome *s*; *ss* two of the four wires which serve to hold the wire gauze.

The Silver Vulcan Medal and ten guineas were presented to Mr. Roberts, by the Society of Arts, for this improved invention.



## PATENT STEAM ENGINE BOILER,

BY MR. JOHN POOLE, OF SHEFFIELD.

This invention consists in placing a series of boilers one over the other, in the manner shown in the annexed engraved figure, which represents a vertical section of the apparatus. The water thus

distributed presents in the aggregate an increased extent of surface, and consequently *it is presumed* by the inventor an increased capability of generating steam, without requiring a corresponding augmentation of the heat or expenditure of fuel; the series of vessels thus arranged being set in a furnace, and surrounded with a spiral flue according to the most improved construction.

The specification of this patent is illustrated by four drawings, representing as many modifications of the apparatus; all these are given in perspective outline, together with the method of filling and regulating the supply of water by means of floats, and also by means of the force pump. As the patentee does not claim these appendages, and as they are well known and in general use, we have left them out in our diagram, and made a single sectional view, which, while it combines the principle of the four perspective drawings, exhibits it in a more palpable manner to the understanding of the quick reader.

*a a a a* are four vessels connected together, *b* supply pipe, *c c c* tubes for conducting the water, successively, into the vessels underneath when it rises above the level shown: to ascertain the depth of water in the lowermost boiler, a pipe and cock must be fixed to it, or some other of the usual means resorted to; *d d d d* are the steam passages from each boiler, and made sufficiently capacious to serve as man holes, when the boilers have to be cleaned out; *e e e e* are waste pipes for drawing off the contents of each vessel.

In one of the patentee's drawings is exhibited a method of cleaning the boilers from sediment or incrustation, by the dragging of chains over their bottoms. For this purpose there is a vertical shaft, with four horizontal arms branching from it, one in each boiler, forming the radius of its circle, to which the chains are suspended. Rotary motion being then given to the vertical shaft by suitable gear, the

chains scour the bottom of each vessel. This application our readers are aware is common in stills, especially in those which are employed by the malt distillers, where the grain is distilled in substance. The patentee proposes to employ his apparatus not merely as a steam engine boiler, but likewise for distillation and evaporation generally: applied as a steam engine boiler, the contrivance appears to us to be new, and we are sorry to add, to possess no advantage; employed as a still its utility is greater, but then, unfortunately, it has little claims to novelty: it bears considerable analogy to Knight's modification of a Woolfe's apparatus, and likewise to Saintmarc's Patent Still, described in our 76th number.

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### London Mechanics' Institution.

No Lectures have been delivered at this Institution since the publication of our last number, on account of the painting of the Theatre, which is now completed; the appearance of it is greatly improved, the embellishments are neat, and harmonize well with each other. We were particularly struck with the excellence of the *graining*, and especially that in imitation of transverse sections of the pollard oak, on the doors of the Theatre, which has been executed by Mr. Jones (one of the Committee of the Institution) gratuitously, in a style that reflects great credit upon his taste and skill.

The following are the arrangements for the ensuing Lectures.—

Friday, 27th April, Dr. BIRKBECK's first Lecture *on the Structure and Functions of the Human Body*: the course to be continued each succeeding Friday.

Wednesday, 2nd of May, Mr. KEAY will resume his course *on the Steam Engine*, and conclude it on the following Wednesday, the 9th of May. These Lectures are illustrated by a very complete and beautiful set of working models of the lecturer's own manufacture.

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### MODE ADOPTED AT LONDON BRIDGE FOR THROWING TWO ARCHES INTO ONE.

THE obstruction given to the water course during the erection of such an extensive edifice as the new bridge, compelled the contractors, engineers, &c. to devise some means to prevent any untoward accident; they accordingly came to a determination to throw, on each side of the bridge, two of the present small and inconvenient arches in one, by that means to lessen the rush of the current, and give greater scope for the navigation of the river. In the construction of this temporary arch or centering, the knowledge of the civil engineer is required to a greater extent than what might be supposed by casual observation. It may possibly be urged, that centerings are constructed on the roof principle, and this is the case to a certain degree; but they, at the same time, require the strength of the arch to support the weight of materials with which they are loaded. In order to accomplish the design, it became necessary to hoard in and take up half the roadway at a time, and clear away for the reception

The principals have a purchase on the girder, shown by dotted lines, and instead of being placed at intervals, as in roofs, they are all fixed and bolted *close together* from one end of the roadway to the

other, forming a complete unbroken mass of timber. On the bressumer, at intervals, pieces of timber are morticed in, forming joists or purloins, D D D, on which are fixed substantial planking, and the road paved as before. These are further strengthened by counter principals; the struts, marked N°. 1, are also fixed close together; those marked N°. 2 have an interval of one width between them. It will be seen that the greatest precaution was necessary in the construction, owing to the bulky and weighty materials continually passing over the bridge from the hop market, tanners and merchants' wharfs, which are situated contiguous to this building. Another difficulty laboured under was to keep the truss sufficiently high, to allow of vessels to pass under; in doing this the span became exceedingly flat, and added to the difficulty of forming the centering.

On the whole this is reckoned to be a good specimen of mechanical and professional skill; and the truss to be the best calculated to answer the desired purpose; which is evident by the one previously executed on the opposite end of the same bridge.

CHRISTOPHER DAVY,

Teacher of Architectural Drawing, &c. Lond. Mech. Inst.  
11, Furnival's Inn.

## History of the Steam Engine, Chap. VI.

*Continued from p. 430.*

A short description of Trevithick's Loco-motive Engine was given at page 110. It appears that the more general adoption of this machine was prevented by a fear that the wheels would not adhere sufficiently to the surface over which it passed, but that they would slip round without producing loco-motion when any considerable load was attached to the machine. To obviate this *imagined* difficulty Mr. Blenkinsop, of Middleton Colliery, near Leeds, obtained a patent in 1811, for the application of a rack or toothed rail laid down on one side of the railway from end to end. Into this rack a toothed wheel is worked by the steam engine: the revolution of which wheel produces the necessary motion without any of the *slipping* alluded to.

The accompanying figure will convey to our readers an idea of Mr. Blenkinsop's plan. The boiler *s* is placed on a wooden or cast-iron frame *y*. Through its interior passes a wrought-iron tube of sufficient diameter to hold the fire and grate; this tube is carried out at the further end of the boiler, when it is bent upwards and continued sufficiently high to form the chimney *s*. *a a* are two working cylinders fixed in the boiler, and which work in the usual way; the piston rods are connected by cross heads to the connecting rods *b b*. These connecting rods are brought down on each side of the boiler and there joined to the cranks *c c*, (there being corresponding cranks on the other side of the machine) which are placed at right angles to each other, consequently the two cranks on the first shaft are horizontal and at their greatest power, at the time the other two are passing the centre. Upon these shafts are fixed (under the boiler)

two small toothed wheels, which give motion to a larger toothed wheel *e*, fixed upon a third axle. A toothed wheel, *f*, is firmly keyed to the end of the central axle, and revolves with the wheel *e*. The teeth of *f* correspond with, and work into a rack, *R R*, stretched along one side of the railway. Motion, therefore, is given by the pistons to the wheels *d d*, which they communicate to the wheel *f* by *e*: a progressive movement is given to the carriage by the teeth of *f* taking hold of the rack.

By this means the load can be drawn up a greater acclivity than by the machine of Messrs. Trevithick and Vivian, the only objection being that the power is applied on one side only, which must have a tendency to force the flanges or projecting rims of the supporting wheels, against the edges of the rails, by which an extra friction would be produced. This, however, is a trifling inconvenience, and is not found in practice to deduct much from the effect of the engines, several of which have, since the date of the patent, been in constant use in drawing coal waggons between Middleton Colliery and Leeds.

In the year 1813 Mr. William Brunton, of Butterly Iron Works, also obtained a patent for a mode of giving motion to carriages by a *very* novel contrivance.

The present engraving represents this Loco-motive Engine, which he terms his "*mechanical traveller*." "The boiler was nearly similar to that of Mr. Blenkinsop's semi-circular (*circular*); there was a

tube passing through it to contain the fuel." The cylinder A was placed on one side of the boiler; the piston-rod is projected out behind horizontally, and is attached to the leg  $a b$ , at  $a$ , and to the reciprocating lever  $a c$ , which is fixed at  $c$ ; at the lower extremity of the leg  $a b$ , feet are attached by a joint at  $b$ ; these feet lay a firmer hold upon the ground, being furnished with short prongs, which prevent them from slipping, and are sufficiently broad to prevent their injuring the road."

On inspecting the drawing it will be seen that when the piston rod is projected out from the cylinder, it will tend to push the end of the lever or leg  $a$  from it, in a direction parallel to the line of the cylinder; but as the leg  $a b$  is prevented from moving backwards, by the end  $b$  being firmly fixed upon the ground, the re-action is thrown upon the carriage, and a progressive motion given to it, and this will be continued to the end of the stroke. Upon the reciprocating line  $a c$  is fixed at 1, a rod, 1, 2, 3, sliding horizontally backwards and forwards upon the top of the boiler; from 2 to 3 it is furnished with teeth, which work into a cog wheel, lying horizontally; on the opposite side of this cog-wheel a sliding rack is fixed, similar to 1, 2, 3, which, as the cog wheel is turned round by the sliding rack, 2, 3 is also moved backwards and forwards. The end of this sliding rod is fixed upon the reciprocating lever  $d e$ , of the leg  $d e$ , at 4. When, therefore, the sliding rack is moved forwards in the direction 3, 2, 1, by the progressive motion of the engine, the opposite rod 4, is moved in the contrary direction, and the leg  $d e$  is thereby drawn towards the engine; and, when the piston rod is at the farthest extremity of the stroke, the leg  $d e$  will be brought close to the engine; the piston is then made to return in the opposite direction, moving with it the

leg  $a b$ , and also the sliding rack 1, 2, 3; the sliding rack acting on the toothed wheel, causes the other sliding rod to move in the contrary direction, and with it the leg  $d e$ . Whenever, therefore, the piston is at the extremity of the stroke, and one of the legs is no longer of use to propel the engine forward, the other, immediately on the motion of the piston being changed, is ready in its turn, to act as a fulcrum or abutment for the action of the moving power, to secure the continual progressive motion of the engine.

The feet are raised from the ground during the return of the legs towards the engine, by straps of leather or rope fastened to the legs at  $f f$ , passing over friction sheeves, moveable in one direction only, by a ratchet and catch worked by the motion of the engine. The feet are described of various forms in the specification, the great object being to prevent them from injuring the load, and to obtain a firm footing, that no jerks should take place at the return of the stroke, when the action of the engine came upon them; for this purpose they were made broad, with short spikes to lay hold of the ground.\*

The next attempt we find to produce a loco-motive steam engine is in the patent of Messrs. Dodd and Stephenson, of Newcastle upon Tyne, a description of which we extract from Mr. Wood's work on rail roads. The patent was dated February 28, 1815, and consisted of the application of a pin upon one of the spokes of the wheels that supported the engine, by which it travelled upon the rail road, the lower end of the connecting rod being attached to it by what is termed a ball and socket joint; the other end of the connecting rod being attached to the cross-beam, worked up and down by the piston.

$a b$  represents the connecting rod, the end  $a$  attached to the cross beam, and the end  $b$  to one of the spokes of the wheel; in like manner the end  $d$  of the connecting rod  $c d$ , is attached to the beam of the other piston, and  $b$  and  $c$  to a pin fixed in the spokes of the wheel B. By these means, the reciprocating motion of the piston and connecting rod is converted by the pin upon the spokes acting as a crank into a rotatory motion, and the continuation of this motion secured by the one pin or crank being kept at right angles to the other, as shewn in the drawing.

To effect this, the patentees had two methods; to crank the axle on which each of the wheels were fixed, with a connecting rod between, to keep them always at the angle, with respect to each other; or to use a peculiar sort of endless chain, passing over a toothed wheel on each axle. This endless chain which is now solely used upon these kind of engines, consisted at first of one broad and two narrow links, alternately fastened together at the ends with bolts; the two narrow links were always on the outside of the broad link; consequently, the distance they were separated laterally would be equal to the breadth of the broad link, which was generally about two inches, and their length three inches. The periphery of the wheels fixed upon the axles of the engine, were furnished with cogs, projecting from the rim of the wheels, (otherwise perfectly circular

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\* Wood on Rail Roads.

and flat) about an inch or one and a half inches. When the wheel turned round, these projecting cogs entered between the two narrow links, having a broad link between every two cogs, resting on the rim of the wheel; these cogs, or projections, caused the chain to move round with the wheel, and completely prevented it from slipping round upon the rim. When, therefore, this chain was laid upon the two toothed wheels, one wheel could not be moved round without the other moving round at the same time with it; and thus secured the proper angles to the two cranks.

This mode of communicating the action of the engine, from one wheel to another, is shewn in the drawing; the wheels A and B having each projecting cog wheels, round which the endless chain passes. This contrivance entirely superseded the use of the cog wheels, and were without the jolts or jerks incident to them; for, when the chain got worn by frequent use, or was stretched, so as to become too long, one of the chains of the axles could be moved back to tighten it again, until a link could be taken out, when the chain was moved back again to its former situation.

It will be seen from this description that Messrs. Dodd and Co's improvement consisted, therefore, of a renovation of Trevithick's plan of propulsion by the mere friction produced by the contact of the wheel and rail. The only material difference between the two

plans being in the using of two cylinders instead of one, and in the method of connecting the axles so as to cause the cranks to continue working at right angles to each other. The purpose of this it will be understood was, that when the one crank was what we call passing the centre the other was at its greatest power, and consequently aided the former in its revolution, when for want of a fly wheel it would have to stop in that situation. It would appear however that this plan was found insufficient to produce a proper effect, for we find that Mr. Stephenson in conjunction with Mr. Losh procured a second patent in 1816, for some improvements upon it. These improvements consisted in the application of steam cylinders placed under the boiler and upon the axles of the wheels : into which were inserted pistons, the rods of which were attached to bearings wherein the axles worked. These pistons being acted upon by the steam in the boiler, performed the part of springs and served the double purpose of keeping all the wheels pressed upon the rails, (when owing to any undulations, there would otherwise have been a tendency in the carriage to have rested only on three, or perhaps in some instances on but two of the wheels,) and of preventing any material injury to the machinery by jolts. The drawing which we use for explanation is the same as Dodd and Co's, and shews six wheels, but by trial it has been found that four were quite sufficient.

The patentees state that :—" in what relates to the loco-motive engines, our invention consists in sustaining the weight, or a proportion of the weight of the engine upon pistons, moveable within cylinders, into which the steam or water of the boiler is allowed to enter, in order to press upon such pistons ; and which pistons are, by the intervention of certain levers and connecting rods, or by any other effective contrivance, made to bear upon the axles of the wheels of the carriage, upon which the engine rests.

*e e e* shew the cylinders placed within the boiler, one side of which, in the drawing, is supposed to be removed, to expose them to view. They are screwed by flanges to one side of the boiler, and project within it a few inches ; and are open at the top, to the steam or water in the boiler ; *g g g* are solid pistons, filling the interior of the cylinders, and packed in the common way to render them steam-tight. The cylinders in the figure are drawn as cut through the middle to shew the pistons. The cylinder is, also, closed at the bottom, and is screwed upon the frame of the engine, as presented at *a a*, Fig. 2. The pistons are furnished with a rod, in a similar way to other pistons, inverted and securely fixed to it ; the lower end of which passes through a hole in the frame which supports the engine, and presses upon the chair which rests on the axle of the wheels on which the carriage moves. The chair has liberty to move up and down with the piston rod. When, therefore, the steam presses upon the piston, the weight is transmitted to the axle by the piston rod, and the reaction of that pressure takes as much weight off the engine. If, therefore, the cylinders are of sufficient area, so that the pressure of the steam upon the whole of the pistons is equal to the weight of the engine, the engine will be

lifted up, as it were, or entirely supported by the steam, which thus forms a kind of spring of the nicest elasticity.\*

(*To be continued.*)

### **Discoveries & Processes in the Useful Arts.**

**IMPROVEMENT AND NEW APPLICATION OF THE COMPASS.**—M. Lebailly has communicated to the French Academy, an improvement in the construction of the magnetic needle, which enables him to ascertain the presence of the smallest quantity of iron in metallic alloys. The sensibility of his instrument is such, that the very small quantity of iron contained in the alloy employed in coining, is sufficient to cause a variation in the needle of seven or eight degrees. It is in contemplation to employ this instrument to the purpose of detecting (which has never been done hitherto with accuracy), the alloy of iron used by the Russians in casting their cannon, which are much more solid than those of the French.

**CEPHALO-SPINAL LIQUID.**—M. Majendie, in describing some experiments which he has been making in the spine with the *moras*, (applications of heat) characterises the cephalo-spinal liquid as one of the most important humours of the body, and as indispensable to the free exercise of the functions of the brain. The ventricles of the spine are constantly full of this liquid. These cavities may contain two ounces of it, without any injurious effect upon the intellectual faculties; but if the quantity should be greater, M. Majendie conceives that a derangement and paralysis of action, and a greater or less diminution of intelligence must take place. M. Majendie is engaged in further researches with respect to this important liquid.

**RICE.**—A new machine for separating the grain of rice from its husk, has been invented in Italy. It consists of two fluted cylinders set in motion by an hydraulic wheel. These cylinders, revolving on a horizontal plane, detach the grain from the panicles. It subsequently passes across a wooden hurdle, while the straw is separated by the movement of the machine.

**A RAIN-WATER CLOCK.**—An old inhabitant of Grenoble, of the name of Blanc, has invented a clock, which is impelled, not by springs or weights, but by water. The rain which falls upon the roof of a house, collected in a reservoir, is sufficient to keep it in perpetual motion.

**PREVENTION OF SMOKE.**—"Dr. Boston, well known in this town, is now in London, to obtain a patent for clearing the metropolis of the dense cloud of smoke in which it is generally enveloped! The process, that of conveying the exhalations in subterraneous flues to a distance from the capital."—*Tyne Mercury*.

**ON THE COLOURING MATTER OF Madder, BY M. M. ROBIQUET AND COLIN.**—Diffuse the ground madder in three or four parts of water, submit the whole to strong pressure and repeat the washing thrice; macerate the residue in a water bath in five or six parts of

\* Wood on Rail-roads.

water, containing half a part of alum ; filter and precipitate the fluid by subcarbonate of soda. The precipitate should be carefully washed ; and the macerations be repeated in alum water until the colour is exhausted. By these means a result is obtained in three hours, which otherwise would require months, and every thing induces the supposition, that the diminution in price of madder lakes, resulting from such simple methods, will permit their employment even on stained paper.

**SILK WORMS.**—From comparative observations which have been made on the silk from Italian worms with yellow balls, and the Chinese race with white balls, it is proved that although the silk produced by the former is much more abundant, that produced by the latter is much more brilliant.

**FRUIT TREES.**—It is said, that if a small trench be dug about 3 or 4 yards from the stem of a fruit tree, and a small quantity of salt is distributed therein, it will, when dissolved, be conveyed to the roots, by means of which the tree will be invigorated, and the quantity of fruit increased.

**PLUMS.**—The *green-gage* may be materially improved by grafting on an apricot or peach stock.

**PEARS** are much improved by grafting upon quince stocks. The quince, used as a stock, has the property of stunting the growth of pears, of forcing them to produce bearing branches instead of sterile ones, and of accelerating the maturity of the fruit. To this cause the excellence of the French pears may in a great measure be attributed.

#### LIST OF NEW PATENTS SEALED, 1827.

**COAL GAS.**—To J. F. Ledsam, of Birmingham, for an improved method of purifying coal-gas. 2 March. Six Months.

**RICE.**—To N. Lucas and H. Ewbank, of Mincing Lane, for an improved process in dressing of rough rice. 10 March. Two Months.

**METAL SCREWS.**—To Samuel Welman Wright, of Kennington Lane, Surrey, for improved machinery for making metal screws. 17 March. Six Months.

**DIAGONAL PRESS.**—To Benjamin Retch, Esq. of Farnival's Inn, for a diagonal press, for transferring perpendicular to lateral pressure. 23 March. Six Months.

**PIANO FORTES.**—To James Stewart of Store Street, Bedford Square, for improvements in piano fortes. 23 March. Six Months.

**BRUSHES.**—To James Woodman, of Piccadilly, for improvements in shaving and other brushes. 23 March. Six Months.

**STEAM ENGINE.**—To Jacob Perkins, of Fleet Street, for certain improvements in the construction of steam engines. 23 March. Six Months. (*These improvements described in the present Number.*)

#### TO OUR READERS AND CORRESPONDENTS.

G. H. Junr's obliging note has been received ; the Editor will avail himself of the information therein contained at the earliest opportunity.

R. I—g's plan is not original : we have seen precisely the same thing in Paris some years ago.

The subject proposed by Mr. B—r, we intend to enter largely upon in our fifth volume.

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# REGISTER

## THE ARTS AND SCIENCES.

No. 101.] SATURDAY, MAY 12, 1827. [Price 4d.

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ELEVATION OF PERKINS'S  
NEW "HIGH PRESSURE SAFETY ENGINE."

## PERKINS'S NEW "HIGH PRESSURE SAFETY ENGINE."

*To the Editor.*

SIR,

From the important nature of Mr. Perkins's improvements in steam apparatus, I feel assured that there needs no apology for bringing the subject of his "High-pressure Safety Engine" again under the notice of your readers; and I cannot do better than preface this description by quoting the concluding remarks contained in the last lecture on the steam engine, delivered by the learned and worthy president of the London Mechanics' Institution.—"Important as many of these stupendous machines are, and great as have been our achievements through their agency, it must be confessed, that with respect to the nature of steam, the construction of steam engines, and their application to the service of man, we are as yet but on the threshold of our knowledge. \* \* \* \*—There is yet, I can confidently assure you, ample room for the exercise of your inventive powers!"

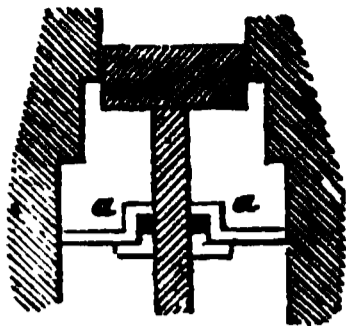
Every candid person will, I think, freely admit that the great talents of Mr. Perkins, seconded as they are by uncommon energy and activity, have enabled him to make more rapid strides towards attaining those great benefits which Dr. Birkbeck has so eloquently described, than any other individual of the present day; for he has constructed an engine of unrivalled portability, and brought highly-elastic steam under perfect control; and, as a consequence, rendered it perfectly safe to employ its vast powers to any extent that may be deemed desirable.

I shall now proceed to describe the inclosed drawings,—and first refer the reader to fig. 2, which represents a longitudinal section of the furnace and steam generators. The latter consists of bars of cast iron 5 inches square, and lying horizontally in the furnace; each of these have a hole cast through them of  $1\frac{1}{4}$  in. diameter, they also have communications with each other in the front and rear of the furnace, where they are so connected as to allow the water to be forced through each of the upper tiers, previously to its being flashed into steam in the lower tier. The connections are formed, as shown by the diagram in the margin, which represents a sectional plan, exhibiting the before-mentioned connecting pipes, herein marked *aa*; these parts are entirely inclosed within the furnace, and are fastened by flanges on the outside, so that should the pipes become loosened, they may be fastened by the adjusting screws of the flanges, which draw them firmly into contact with each other, as I will presently more particularly describe. By the operation of a forcing pump, connected to and worked by the engine, the water is injected into the two upper tiers of tubes, marked A, (fig. 2,) wherein the water is raised, and kept up to a temperature of between 7 and 800° Faht. The lower tier, I, is kept at a heat of about 1000°



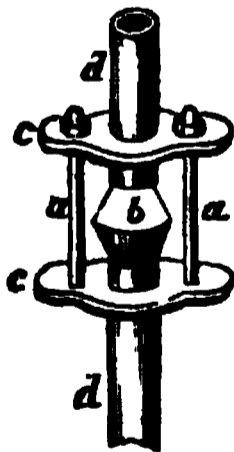
**Fab.** so that at every stroke of the engine a certain quantity of water is displaced from the upper tiers, and discharged from the pipe **B** into the valve box **C**, which opening downwards is received into the lower tier of tubes, and instantly flashes into steam; from thence it rushes into the steam chamber **L**, and the valve **C** is replaced in its seat by the agency of a weighted lever; the notches **F** show the fulcrum of the same. **G** is a loaded valve, to relieve the pressure in the steam chamber should it become overcharged with steam; **H** is the pipe which conveys the steam to the working cylinder, (the continuation of this pipe is shown at **B**, fig. 1); at **K** is an opening in front of the furnace to supply the same with fuel.

The steam being now generated at a pressure of 800 lbs. on the square inch, it passes through the pipe **B**, fig. 1, enters the pipe **D** at **C**, and from thence enters the working cylinder **A** at **E**. The steam has apparently no sooner entered the cylinder, than by the action of the rod **S**, which is fixed to the lever **G** and acted upon by the cam **F**, (dotted) it is shut off, the piston having then only performed one-eighth part of its stroke of 20 inches; the steam by its own expansion drives the piston downwards, and when at **H**, where



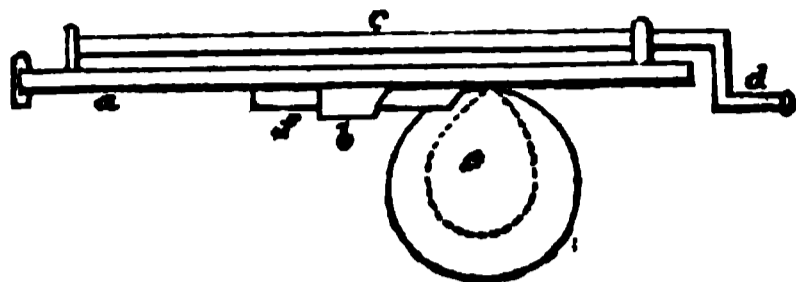
there is an enlargement of the cylinder, the steam is reduced to 100lbs. upon the inch, occupies the space *aa*, and from thence is conveyed to the condenser I. The lower extremity of which, T, is furnished with a box and two valves opening outwards, which valves close by their own weight, when the steam has expanded to the common atmospheric pressure: the lever K now performs its office, which being worked by a cam, the cock L is turned, by which movement a jet of water is thrown up the pipe N into the condenser I; and the steam therein is thereby converted into water, and nearly a perfect vacuum effected. The water from the valve box runs down into the hot well, and by the forcing pump is re-conducted into the upper tier of generating tubes, while the uncondensed steam in the expansive vessel escapes by a pipe in the side of the vessel *n*, at each successive stroke of the piston, and is conveyed off by the flue of the furnace. The momentum of the fly wheel elevates the piston to the top of the cylinder, and the operation is repeated as already described. Such is the manner in which this powerful machine is worked.

I will now proceed to notice a few of those obstacles which Mr. Perkins has had to surmount, and which at first sight appeared insuperable. First, the carbonizing of the lubricating materials, employed to reduce the friction, such as oil, tallow, &c. This he has accomplished by availing himself of the important discovery of a peculiar metallic alloy, with which the piston has been constructed, that requires no grease whatever, the friction being less without the use than with the use of it. Secondly,—Keeping the joints of the pipes steam-tight:—This is effected by a very novel and beautiful mechanical contrivance, shown near B, (fig. 1,) but on an enlarged scale by the figure in the margin; *b* is a piece of metal of the figure of two cones united at their bases, with their apices inserted in the pipes *dd*; *cc* are flanges fixed to the pipes, and connected by regulating screws *aa*, which being turned draw the pipes *dd* firmly in contact with the intervening cone *b*. In this same manner the flanges of the furnace are made to tighten the transverse short connecting pipes already described. Thirdly,—Preventing any accident that might arise from the steam in the chamber L, fig. 2, becoming surcharged with caloric.\* Even since the short time that this engine has been constructed, two valuable improvements have been made by Mr. Perkins, proving, were it necessary, the accuracy of Dr. Birkbeck's remark, that in these machines there is



\* Mr. Perkins has a very novel and effectual mode of accomplishing this, which we were confidentially made acquainted with, but are not warranted in disclosing at present.—EDITOR.

yet ample room for the inventive powers of the ingenious. The first of these consists in a mode of shutting off the steam at  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ , &c.



(as may be required,) of the stroke of the engine, it is accomplished thus, and is an improvement on the lever G in fig. 1. *a* is the lever, *b* a shoulder containing the wedge *f*,

*c* an adjusting screw, to shift the wedge backwards or forwards. Now the cam, *e*, in its action will have to traverse round the hollow curved end of the wedge, and will consequently prolong the time of admission for the steam to the cylinder; *d* is a crank handle to adjust the screw and wedge *c* and *f*. The other improvement consists in reversing the motion of the fly wheel; a circumstance Mr. Perkins justly thinks invaluable, especially in whim engines for mines, and also for steam navigation. The cam F, fig. 1, is dotted, and supposed to show the situation of it on the opposite side of the wheel; in the improvement Mr. Perkins has put one on this side of it, and so arranged, that when the connecting rod and crank is rising toward the dead point, by shifting the lever G on to the cam on this side, the steam is immediately re-admitted, driving the piston back before it reaches the top of the cylinder, the force of which reverses the motion.

The following are among the advantages that result from the use of this engine. First,—Its *perfect safety*, resulting from the immense strength of the generating tubes; and should it be possible to burst them, that effect would in all probability take place without displacing a single brick in the furnace. Second,—A *reduced consumption of fuel*, equal to one half. Third,—Its *diminished bulk*;—and Fourth,—Its greatly *reduced cost* when compared to other engines, and the facility of making repairs.

The following proportions of the engine may, perhaps, be acceptable information :—

The power is calculated to be equal to 30 horses. The fly wheel 8 ft. diameter,—weight 28 cwt. Diameter of piston 8 in.—stroke 20 in. Circumference middle of connecting rod 10 in.—length of do. 3 ft. 7 in. Circumference of piston rod  $6\frac{1}{2}$  in. Do. of steam pipes, B D, fig. 1.  $5\frac{1}{2}$  in. The remaining minute parts may be examined by the scale for both drawings, attached to fig. 1.

Mr. Perkins's method of showing the power of his engine, (the accuracy of which he does not conceive equal to that of pumping or grinding, neither of which were convenient for him to adopt,) was, however, near enough to show great economy in the consumption of fuel; it is as follows. A strong lever is made to press on the periphery of the fly wheel, the long arm of which is eight times the length of the short; and on the end of the long arm of the lever weights are suspended. Its best action I will now state: the steam at 800 lbs. pressure per square inch being admitted into the cylinder, and shut off when the piston had made one-eighth of its stroke; it made an average of 60 strokes per minute. The weight on the end

of the lever was full 300 lbs. from which *deduct two-thirds, for the difference between weight and friction, which was found by experiment to be within a fraction of correct*, and the following calculation will show the extraordinary result.

300 lbs. being the weight on the end of the lever,  
multiply by 8, being the difference between the long and [short arm,

showing a constant pressure of 24,00 on the periphery of the wheel.

Now find the number of feet this wheel moves per minute, which being 25 ft. in circumference, and making 60 revolutions per minute, (25×60) is 15,00 by which multiply the pounds weight [pressing upon the wheel.

1200000  
24,00

this sum to be 3600000  
multiplied by 60 (minutes in the hour,)

216,000000 and the product to be divided by 3  
3) ————— for the difference between weight and friction,  
72,000000

it would appear that 72,000000 lbs. was raised one foot high with 48 lbs. of coal, which was the amount consumed each hour.\*

This method of testing the power of the engine is not so erroneous as some appear to imagine. To ascertain the difference between this kind of friction and weight, the wheel was fixed, and a given weight (using the same rubbing surfaces) was made to move with about the same velocity, as the wheel moved in the experiment. A weight being suspended over a pulley drawing the weighted lever horizontally, it was found that one pound would give motion to three. Many experiments have been made at different densities, and the results went to prove that the higher the steam was compressed, the greater is the saving of fuel, for it takes but very little more fuel to generate steam of 50 atmospheres than that of 25.

I cannot close without expressing the great obligations I am under to Mr. Perkins for the very handsome manner in which he has furnished me with the necessary information to enable me to make this communication; and for the obliging readiness he displayed in the full explanation of his interesting and useful improvements.

I remain, Sir, your's respectfully,

CHRISTOPHER DAVY,

Teacher of Architectural Drawing, &c. Lond. Mech. Inst.  
11, Furnival's Inn.

### THIN'S PATENT SMOKE JACK.

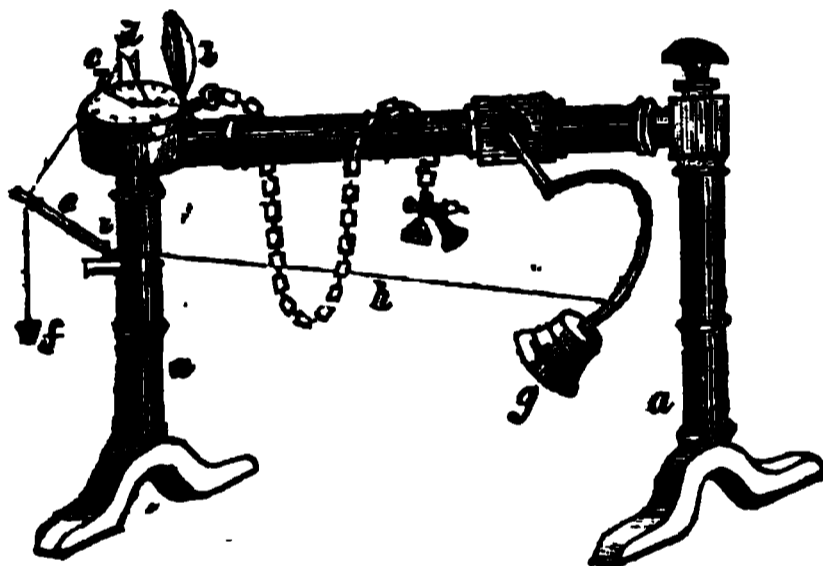
A PATENT for a smoke-jack has lately been taken out by a Mr. Thin, of Edinburgh, which has the advantage of great simplicity to

\* This, I believe, is only about 1-5th of the consumption of Bolton and Watt's engines.

recommend it. The revolving flyer, containing the fans on which the smoke, or rather the current of air acts, is placed in a *vertical* position (instead of a horizontal one, as usual): one half of this fan-wheel is inclosed in a semi-cylindrical case, while the other half is exposed to the current passing up the chimney, which acts successively upon each fan, as it emerges from the case or screen. Thus merely a band from a pulley on the axis of the flyer would suffice to give motion to the spit; but as the revolutions would in that case be too quick, a pinion is added to the axis of the flyer, which turns a larger toothed wheel; the axis of the latter, therefore, carries the pulley for the band or chain connected to the spit.

### JOHNSTON'S WATCH ALARUM.

IN passing through Brook Street, Holborn, our attention was attracted to a very complete little apparatus of the above description, in the shop window of N<sup>o</sup>. 8. We examined it very particularly, and found it to perform very accurately. The expense is only seven shillings, and it is got up in a neat and an elegant manner.



*a a a a* is the mahogany stand; *b* the watch laid in a cavity adapted to receive it, in such a position, that the hour at which a person wishes to rise comes opposite to a fixed index *c*; a fine line, consisting of a single horse-hair, with a loop at the end of it, is then laid into the notch of the guide *d*, and the loop passed over the hour hand of the watch. At *e* is a light ivory lever; to this the horse-hair is tied about midway of its length, with a weight *f* suspended to its lowest end. The bell *g*, fixed on its steel spring, is then brought into the position shown by the line *h*, the extremity of which is provided with a long brass wire hook; passes over the extremity of the lever, and is then put on to the upright pin *i*. When, by the process of time, the hour hand has arrived to the period of time proposed opposite to the point of the index, the horse-hair slips from it, the little weight becoming unsupported, pulls down the ivory lever, raises the hook off the pin *i*, which releasing the spring, the bell is set ringing.

## ON THE EXPLOSION OF STEAM BOILERS.

BY JACOB PERKINS.\*

It has been generally considered a well-established fact, that the caloric of steam, at a given elasticity, is invariably the same when in contact with water; but this is far from being the case. It may be, and often is, so generated, as to indicate very high degrees of temperature without a corresponding increase of power, so as evidently to prove that temperature alone cannot be relied on as a measure of the elastic power of steam. Many experimentalists have thus undoubtedly been led into error, especially in reference to high temperatures. If any part of the boiler which contains the steam be suffered to become of a higher temperature than the water contained in it, from want of a sufficient supply, the steam will readily receive an excess of caloric, and become supercharged with it, without acquiring proportional elasticity. In some recent experiments I have heated steam to a temperature that would have given all the power that the highest steam is capable of exerting, which would have been 56,000 pounds to the square inch, if it had its full quantum of water; yet the indicator showed a pressure of less than five atmospheres. Having satisfied myself, by repeated experiments, as to the certainty of this curious fact, the thought struck me, that if heated water were suddenly injected into the super-heated steam, the effect would instantly be the formation of highly-elastic steam; the strength of which would depend upon the temperature and quantity of the supercharged steam, and of the water injected. To ascertain the truth of this theory, I made the following experiments.

A generator was filled with water, and heated to about five hundred degrees, and, consequently, exerting a force of about fifty atmospheres; but the pressure valve being loaded to about sixty atmospheres, it prevented the water from expanding into steam. The receiver, which was destitute of both water and steam, was heated to about twelve hundred degrees: a small quantity of water was injected into the generator with the forcing-pump, which forced out from under the pressure valve into the receiver, a corresponding quantity of heated water; and this instantly flashed into steam, which, from its having ignited the hemp cord that covered the steam-pipe ten feet from the generator, must have been at a temperature of at least eight hundred degrees, which would be equal to about eight hundred atmospheres; but from want of water to give it its necessary density, the indicator showed a pressure of about five atmospheres. Whether the pressure of the steam, which was rushing through the steam-pipe, was at five or one hundred, or more atmospheres, the steam-pipe kept up at the high temperature before mentioned, which I attributed to the steam being supercharged with caloric. The pump was now made to inject a much larger quantity of heated water, and the indicator showed a pressure of from fifty to eighty atmospheres: it soon expanded, the throttle valve being partly opened, to the former pressure of about five atmospheres. The water was then injected again and again, and the indicator was observed to oscillate, at each stroke of the pump, from five to between forty and one hundred atmospheres, according to the quantity of water injected; clearly showing that, at this reduced pressure, there was a great redundancy of heat, with little elastic force. It soon occurred to me, that to this might be traced the true cause of the tremendous explosions that suddenly take place in low as well as high-pressure boilers.

There are many instances where, immediately before one of these terrific explosions had taken place, the engine laboured; showing evidently a decrease of power in the engine. To illustrate the theory of sudden explosions, let us suppose the feed-pipe or pump to be choked; in this case the water would soon sink below some parts of the boiler, which should be constantly covered by it, thus causing them to become heated to a much higher tempera-

\* The author's observations on this important subject, appear to us so luminous and valuable, that we have not hesitated to give them a place in this number, to the exclusion of several novel patented inventions.—EDITOR.

ture than the water. The steam now being in contact with the heated metal, readily takes up the heat and becomes supercharged with it.\* Since caloric will not *descend* in water, it cannot be taken up by the water which is below it. The steam thus supercharged, will heat the upper surface of the boiler in some cases *red-hot*†, and will ignite coals or any other combustible matter which may be in contact with it. If the water which is kept below the supercharged steam by the pressure of it, should, by any circumstance, be made to take up the excess of caloric in the steam, as well as that from the upper part of the boiler, which has become heated above the temperature of the water, in consequence of the water having been allowed to get too low, it will instantly become highly-elastic steam, and an explosion cannot be prevented by any safety-valve hitherto used. To show how the water may be suddenly brought in contact with the overheated parts of the boiler, as well as with the supercharged steam, it will be necessary to state the following facts.

As long as water is not heated above 212 degrees it will simply boil and give off atmospheric steam, without the water having any tendency to rise with it; but as it becomes more and more elevated in temperature, its disposition to rise with the steam becomes more and more apparent; but as the steam presses on the surface of the water in the same ratio as the water increases in temperature, it only boils without rising, as when at atmospheric pressure; but if the steam should be drawn off faster than it is generated, this artificial pressure would be taken off, and the water would rise with the steam in proportion to the suddenness and rapidity of its escape. The water and steam in this mixed state, thus filling every part of the boiler, the excess of caloric in the supercharged steam, as well as the excess of heat from the boiler, will be instantly taken up by the water which rises with the steam, by which means the steam becomes sufficiently dense (or powerful) to produce the fatal effects too often experienced, not only from high but from low pressure boilers. If, for instance, the water (as has before been noticed) which is exposed to the fire should be suffered to get below any part of the boiler, the steam will soon become supercharged with heat. If a boiler thus circumstanced should have the weight taken from the safety valve,‡ or a small

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\* Practical engineers have frequently witnessed the destruction of the packing of pistons by their becoming charred, although the steam issuing was in contact with the water, the temperature of which did not exceed two hundred and thirty degrees. It is very evident that this steam was surcharged with heat, and was much above the temperature of the water upon which it was reposing, and in a suitable state to produce explosion, had the water been allowed to rise with the steam, by drawing it off faster than it was generated.

† Mr. Moyle, a practical engineer from Cornwall, gave me the following interesting fact:— On going into his boiler-room, he observed a ladder, the foot of which rested on the top of his boiler, to be in flames: he instantly ascertained that the top of the boiler, from some cause which he was then unable to determine, had become *red-hot*; with all possible promptitude he ordered the fire to be quenched, which probably saved his premises, and perhaps his life. Mr. Moyle found, upon examining the boiler when cold, that very little water remained in it. NOTE A.

A stronger case still, was that of an explosion at the iron-foundry at Pittsburgh, North America. As is the practice in North America, a high-pressure engine, of sixty or eighty-horse power, was supplied with steam from three separate cylindrical boilers, each being thirty inches diameter and eighteen feet long. One of these boilers had for some time been observed to be getting *red-hot*; but as the other two supplied a sufficiency of steam for the work then doing, it was disregarded until it exploded. The main body of the boiler separated from one of its ends at an angle of forty-five degrees, and passed off like a rocket through the roof of the building, and landed about six hundred feet from it.

‡ It was stated in evidence at the coroner's inquest taken at the Humber, in the case of an explosion on board of the Graham steam-boat, that just before the explosion took place, twenty pounds were taken off the safety valve. Now if the steam in this boiler had been properly generated, the relief given to the safety valve could not have produced explosion; but if the water had got low in the boiler (as was probably the case), and the steam supercharged with heat, the ready way to produce explosion was to allow the steam to escape faster than it was generating, when kept in the lower part of the boiler by the pressure of the confined steam.

Several instances have occurred when there has been sufficient warning, by the rushing of the steam from a rent or fracture, for the bystanders to escape from injury before the explosion took place. There has been at least one case where the boiler was raised from its bed into the air by the force of the steam issuing from the rent, (upon the principle of the rocket), before the water had sufficiently expanded, by the removal of the steam, caused by the rent or fracture, to take up the heat of the boiler and the supercharged steam, when an explosion took place after the boiler had been raised many feet in the atmosphere, and a separation took place with great report, one part rising still higher, while the other dashed with great force on the ground. It is, I believe, a fact, that more persons have been killed by *low* than by high pressure boilers. It is about twelve

rent effected in the boiler from its giving way by the pressure of the steam, an explosion will be sure to follow. A remedy for this kind of explosion, which appears to be the only serious one, is that of not allowing the water to subside below any part of the boiler which is exposed to the fire. In case the water should settle, it may be known by having a tube, with its upper end trumpet-mouthed, and its lower end fixed in the boiler, entering a few inches below the surface of the water; then, as soon as it subsides sufficiently to allow the steam to blow off, the blast will give warning that no time should be lost in supplying water or checking the fire.\* When highly supercharged steam is rushing from the safety valve, or any other aperture, it may be known by its perfect invisibility, even in the coldest day, nor can be seen at any distance from the valve or cock; it is, however, condensible, as may be seen by holding any cold substance in its range.

*N. B. Our next impression will contain Mr. Perkins's observations on the economy of using highly elastic steam expansively, with explanatory diagrams.—*  
EDITOR.

## History of the Steam Engine, Chap. VI.

*Continued from p. 447.*

These loco-motive engines have been long in use at Killingworth colliery, near Newcastle, and at Hetton Colliery, on the Wear, so that their advantages and defects have been sufficiently submitted to the test of experiment; and it appears that, notwithstanding the great exertions on the part of the inventor, Mr. Stephenson, to bring them into use on the different rail-roads now either constructing or in agitation, it has been the opinion of several able engineers, that they do not possess those advantages which the inventor had anticipated; indeed, there cannot be a better proof of the doubt entertained regarding their utility than the fact, that it has been determined that no loco-motive engines shall be used in the projected rail road between Newcastle and Carlisle, since, had their advantages been very apparent, the persons living immediately on the spot in which they are used, namely, Newcastle, would have been acquainted therewith.

The principal objections appear to be the difficulty of surmounting even the slightest ascent; for it has been found that a rise of only one-eighth of an inch in a yard, or 18 feet in a mile, retards the speed of one of these engines in a very great degree, so much so, indeed, that it has been considered necessary, in some parts where they are used, to aid their ascent with their load by fixed engines, which drag them forward by means of ropes coiling round a drum.

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months since sixteen persons were killed by the bursting of a low pressure boiler in Flintshire. High pressure boilers have since been substituted. Some of the most dreadful accidents from explosions which have taken place in America have occurred from low pressure boilers.

\* This will apply only to low pressure boilers, on account of the height of the column which would be required to balance the pressure of the steam. The high pressure engines, as used in Cornwall, would require a column varying from 60 to 120 feet; and the new high pressure safety engine, now coming before the public, would require a column more than four times as high as St. Paul's cross to balance the steam.

NOTE A.—The following similar fact to that mentioned p. 457 has been recently communicated to me by Mr. Williams, principal manager of the Dublin and Liverpool Steam Company:—He was alarmed in the night time, during one of his passages from Ireland to Liverpool, by the strong smell of burning pine, which, after a diligent search, he found to proceed from a pine block which had been accidentally thrown on the top of the boiler, and which was discovered to be on fire.

The steam cylinders below the boiler, which *constituted* the patent, were found very defective, for, in the ascending stroke of the working piston they were forced inwards by the connecting rod pulling at the wheel in turning it round, and in the descending stroke the same pistons were forced as much outwards; this motion or play rendered it necessary to increase the length of the working cylinders as much as there was play in the lower ones, to avoid the danger of breaking or seriously injuring the top and bottom of the former by the striking of the piston, when it is forced too much up or down. As our meaning may not be fully comprehended without elucidation, let us imagine the cylinder of a common beam engine to be set upon springs, which have a play of one foot: the weight of the cylinder, when at rest, depresses the spring six inches, but if the engine be put in motion, *then* as the piston ascends and gives motion to the machinery, the springs below the cylinder being, as it were, the abutment upon which the steam acts, are forced downwards against their seat, with precisely the force that the piston exerts in overcoming the resistance of the machinery. In like manner when the piston descends, as much weight or pressure will be taken off these springs by the same means. The cylinder would, therefore, vibrate or dance upon the bearing springs: and, as the motion which it thus obtains is the reverse of the motion then given to the piston, the length of the cylinder should be lengthened to allow for the extreme vibration to which it is liable. A quantity of steam would therefore be lost in filling up this extra length of the cylinder at each stroke. This would also happen if the cylinder were *fixed* as usual, and the carriages of the crank and fly wheel supported upon springs, and this arrangement would then be exactly the same in principle and effect as the parts of the loco-motive engine to which we now allude.

Mr. Trevithick's patent of 1815 is introduced a column or ring of water, which running round the piston renders the whole air-tight. By this means he avoids a great proportion of the usual friction, a very moderate degree of tightness in the packing, being in practice found sufficient to prevent the passage of so dense a fluid as water. The second part of this invention consists in causing steam of a high temperature to spout out against the atmosphere, and by its recoiling force to produce a motion in a direction contrary to the issuing stream, similar to the motion produced in a rocket wheel, or to the recoil of a gun, by which means a rotative action is produced. Mr. Trevithick also describes three other improvements on the high-pressure engine, the latter of which, though only applied to nautical purposes, is by far the most important. It consists in employing a spiral worm or screw, similar to the vanes of a smoke-jack, which, being made to revolve at the head or stern of the vessel, produces the required motion.

Mr. Turner's Rotative Engine, patented in 1816, displays extraordinary ingenuity and excellence; we therefore give a more enlarged account of it from the specification than of most other such inventions.

" Fig. 1 is a plan of the engine, represented as if opened to show

| I | A |
|---|---|
| x | 3 |
| 2 |   |
|   | ) |

the internal structure. Fig. 2 is another plan. Figs. 3 and 4 are sections, taken through the axis of the engine in different directions, to show the internal parts. A A, B B, C C, is the cylinder or external case of the engine, made in two or more parts, which are fastened together with screws, so as to form a circular or annular passage, the transverse section of which is likewise circular, as shown at E E, Figs. 3 and 4; the piston F, Fig. 1, is accurately fitted into this circular passage, and is caused to revolve therein by the pressure of the steam, which is applied behind it or on the side F, whilst a vacuum is made before it, or on the side G. The piston being connected with a central plate G, which is fixed fast upon the axis or shaft H; the said shaft is put in motion, and by wheel work I, or other machinery which is best adapted, the power of the engine is communicated to any useful purposes to which it is intended to be applied. The means by which the force of steam is made to produce the rotatory motion is as follows: two valves or sliders, K and L, are applied at the opposite sides of the annular passage or cylinder, E E, in the manner represented in Figs. 1 and 3. The edge of the central plate G, which has the projecting arm to communicate with the piston, must be made so that they can be made to shut up the passage of the cylinder, E E, as represented at L, and prevent the passage of the steam through the same, or the slider may be opened, as shown by the dotted lines, to allow the piston F to pass freely through the cylinder; this is done by moving it sideways on its centre 3 out of the cylinder into the box or case M, which is provided for its reception. The sliders are put in motion by a communication from the outside of the engine, so that each one shall begin to open as soon as the piston F approaches it, and shall be completely opened whilst the piston passes by, and that it shall then descend again upon its seat. N O, Figs. 1 and 4, are two passages, through each of which the steam is alternately introduced and withdrawn from the cylinder; the two passages are placed on opposite sides of the centre of the engine, and are provided with valves or cocks, which are adapted to be opened and by the action of the machinery in such succession, that when steam is entering from the boiler, into the cylinder at one passage, it shall be going out into the open air or to the condenser at the opposite passage. The machinery which actuates the slides, K L, and the machinery which opens the valves for the admission and exhaustion of the steam through the passages N and O, acts in concert with each other, and also with the motion of the piston F, so that, as soon as possible after the piston has passed by the seat of a slider, the same shall be lowered down into its place ready to close the passage of the cylinder behind the piston, and the instant the piston has passed by the next opening the steam is admitted to flow therein, and act between the slider and the piston, to force the same forwards in the cylinder by its expansive force. To explain the action of the engine more clearly, suppose the parts in the position of Fig. 1; the slider L is shut, and the steam is flowing through the passage O into the space between the slider L and the piston F, at the same passage N is open to the condenser, to exhaust

the steam from the remaining part of the cylinder, and remove the pressure from the front side G of the piston. In consequence, the pressure of the steam acting behind the piston of the side F, puts the same in motion in the direction of the arrow, and drives the arm of the central plate before it. The slider K, now in the act of opening, and by the time the projecting part of the plate G arrives at its seat, it will be quite open into the box M, where it will remain until the piston F has passed by its seat; it then begins to descend, and by the time the piston arrives at the opening of the passage N, the slider K will be completely shut and stop the cylinder. The instant the piston has passed over the opening of the passage N, the steam valves are changed by the machinery, so as to admit the steam into the passage N, and also to allow the steam to pass away through the other passage O to the condenser; in consequence the steam enters the space between N and K, and thus, being behind the piston, drives it still forwards towards the slider L, which immediately begins to rise by the action of the machinery, and as soon as the projecting part G of the central plate approaches it, it will have retreated into

the box M, leaving the cylinder free for the passage of the piston. Immediately after the piston has passed the slider, L descends again, and gets settled to its place by the time the piston arrives at the opening O; and the instant the piston has passed over this opening the steam valves are changed again, so that the steam will be admitted at O behind the piston, and act between the slider L and the back of the piston to force it forwards, which is the same position represented in the figure. By this means the pressure of the steam is always made to act behind the piston, and the vacuum is made before the same. The sliders K and L are put in motion by levers 9 and 10, which are fitted on the outsides of the boxes M, but move upon the same centre pins 3, as the sliders move upon withinside the boxes, the levers being forked, as shown at Fig. 5, to reach on each side of the boxes, and the centre pins 3 pass through the sides of the boxes, and also through both forks of the levers 9, 10, but do not turn round in the holes. To communicate motion from the levers at the outsides of the boxes to the valves withinside, curved rods, 11, 11, are carried from the levers through the sides of the boxes M, and jointed to the arm of the sliders; stuffing boxes are formed round the rods to make tight fittings where they pass through the sides of the boxes M; the ends of the levers, 9, 10, are made to be included in an eccentric groove or rein Z Y, fixed to the central axis H; the form of this is shown in Fig. 2, and is such as to hold sliders shut, except during the time that it is necessary to lift up the same to allow the piston to pass by. To make the sliders fit steam-tight when they are shut, they are made rather larger than the diameter of the cylinder, and are received in grooves made round in the inside thereof, and the valves are ground against one of these faces of each of these grooves, so that they will fit tight without any packing. The piston is made of several segments put together, with springs behind them to throw them out against the inside surface of the cylinder, and it is thus made tight without any packing of hemp.

“ The edge of the central plate G, which has the projecting arm to communicate with the piston, must be made to fit tight between the upper and lower halves which compose the cylinder, so as to prevent the escape of steam between them, and at the same time leaving the said plate freely at liberty to revolve in the space; for this purpose the edge of the plate is surrounded by two rings of brass, 5 and 6, which are laid one upon the other with springs between them, so as to throw them against the upper and lower surfaces of the central space, to which they are accurately fitted by grinding; these rings extend round rather more than half the circumference of the plate G, and are attached thereto by a joint pin 7, Fig. 1, which causes them to revolve with it; but they require no other fastening, as the pressure of the steam will keep them in their places.

“ To prevent the escape of the steam through the opening or division between the two rings 5 and 6, a third ring, 7, 8, fitted to them, cover the joints, and the external edge of this which is made round or semi-circular like a bead, is received into corresponding notches made in the edges of the sliders, and thus to make a fitting between the edges of the sliders, when the same are closed, and the

edge of the moveable central plate. The valves which are to admit alternately the steam into the passage N O, may be constructed in the same manner as the valves for the ultimate supply of the upper and lower part of the cylinder of any common steam engine; but the most convenient manner of doing this is shown in Fig. 4, Q Q, is an iron box, into which the steam from the boiler is admitted; this box is fixed beneath the cylinder of the engine; 17, 18 are two openings from which curved tubes proceed upwards to the openings N O of the cylinder; there are also two other openings, 19 and 20, which turn downwards with crooked tubes to the condenser S. T V are boxes or cups fixed at the opposite ends of a lever T W V, of which W is the centre of motion; the boxes or cups are intended to cover the openings, in the manner represented by the figure, and the faces or edges of the boxes are ground to fit close upon the flat plate or surface, in which the openings 17 and 18 are made. When the box T is up, as in the figure, it covers the two openings, 17 and 19, so as to connect them together, and therefore the steam in the cylinder will be drawn off through 17 and 19 to the condenser; at the same time the box V at the opposite end of the lever is drawn, and in this position the box leaves the opening 18 uncovered, so that the steam with which the box is filled will have free passage into the cylinder; by moving the lever T V on its centre W, sufficiently to raise up the box V, and depress the other T, the action will be exactly reversed, viz. the box V will connect the openings 18 leading from the cylinder at the opening 20, which leads to the condenser; and the opening 17 will be uncovered, so as to admit the steam from the box through it into the cylinder at the opening N."

(To be continued.)

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**METHOD OF CUTTING GLASS.**—If a tube, a goblet, or other round glass body is to be cut, a line is to be marked with a gun flint, having a sharp angle, an agate, a diamond, or a file, exactly on the place where it is to be cut. A long thread, covered with sulphur, is then to be passed two or three times round the circular line, is to be inflamed and burnt; when the glass is well-heated, some drops of cold water are to be thrown on to it, when the pieces will separate in an exact manner as if cut with scissors. It is by this means that glasses are cut circularly into thin bands, which may either be separated from, or repose upon, each other at pleasure, in the manner of a spring.—*Jour. de Connaissances Usuelles*, vol. 1, p. 15.

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#### TO OUR READERS AND CORRESPONDENTS.

The List of New Patents is deferred until our next.

The Communications of W. J. H.—J. B. jun.—and A Subscriber,—have been received.

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# REGISTER

OF

## THE ARTS AND SCIENCES.

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HANCOCK'S  
MACHINE FOR BORING SQUARE HOLES, AND  
MAKING RECTANGULAR MORTICES.

VOL. IV.

■ ■

## HANCOCK'S MACHINE FOR BORING SQUARE HOLES.

THIS very useful and ingenious instrument was invented by Mr. Thomas Hancock, (the patentee of the Artificial Leather Manufacture) of Goswell Mews, Goswell Street, about eight or nine years ago ; at which time he intended bringing it before the public ; but his attention having been occupied since that period with matters of greater interest or importance, the boring machine was set aside for a more convenient opportunity ; and it would probably have still remained in neglect, had not our trans-atlantic brethren recently claimed the invention as originating with themselves. We have no reason to doubt that the American claimant, Mr. H. Branch, of New York, did not himself contrive the machine described in the Franklin Journal, wherein the first account was inserted : all that we have to state on this point is, that the *priority* of the invention of a machine for the purpose, belongs to our own countryman ; and to show that there is a considerable dissimilarity between the two contrivances, we shall first insert the description of that invented in America, which we extract from the Franklin Journal.

—“ It consists of an auger, formed like the ordinary American screw auger, with the twisted part enclosed in a case or socket, extending from the upper part of the twist to the cutting edge, allowing the small entering screw only to project beyond it. The external form of the socket is either square or otherwise, according to the intended shape of the hole to be bored, a large portion of its sides being cut away to allow the chips to escape. The lower end of the socket is of steel, with a sharp cutting edge, bevilled towards the inside. The cutting edges are not allowed to terminate in right lines, but are made concave, so as to admit the angular points to enter the wood first ; this causing it to cut with greater ease, and more smoothly than it otherwise would. The upper part of the socket forms a collar, which works freely on the shank of the auger, just above the twisted part, and is retained in its place by a pin and other appendages.

“ When a longitudinal hole or mortice is wanted, two or more augers are placed side by side, furnished with their appropriate sockets, and retained in their places by obvious contrivances.”

It is stated to be efficient in its operation, boring a square hole with well-defined angles, with nearly the same rapidity as a round one of the same diameter, and forming it with a degree of truth unattainable by the ordinary methods.

On the first publication of Mr. Branch's invention in this country, Mr. Hancock invited us to his manufactory to see a machine for the same purpose, which we readily availed ourselves of, and were much gratified in beholding a very complete apparatus, of excellent workmanship, executed by Mr. Hancock himself many years previous. The effectiveness of its operation we repeatedly witnessed, and proved it ourselves by boring several square holes of an inch wide, through thick pieces of wood, with surprising facility and dispatch ; upon

examining the apertures thus made, we found the angles to be mathematically true.

Mr. Hancock has declined availing himself of a patent for this invention, but offers it as a free gift to the public, through the medium of this work, as being the best calculated to give it the requisite publicity; but owing to the pressure of our other avocations we have been prevented from making the necessary drawings of it until this late period; the engravings of them, now given in the frontispiece of this number, will, we think, convince the attentive reader that Mr. Hancock's is a more effective machine than Mr. Branch's: we will, however, without further remark here, describe the construction with reference to the figures.

*a a*, fig. 1, is a strong iron frame or support, fixed by screw bolts, *b b*, to the work bench *c*; *d* is an octagonal iron socket containing a brass bush, which is tapped to receive the vertical screw, *e e*; to this screw is affixed, by a circular tenon and mortice, the square perforating instrument, *f*, which accurately fits and slides up and down through a rectangular hole, in a guide of brass, *g*, when the screw *e* is turned by the cross handle at top; so that a square incision is made by direct pressure downwards, at the same time that the revolving centre bit, *m*, cuts out a completely round hole, the chips rising up and passing out at the two open sides of the square cutter: *h* is a piece of wood in the act of being bored, the dotted lines showing the depth to which the perforation has reached: the small piece of wood, *i*, is placed underneath, to prevent injury to the cutting tool by coming in contact with the cross iron plate, *k*; the bolts, *b b*, passing through *i* as well as *k*, secure both firmly to the bench, *c*: this figure is drawn to a scale of one third the original model in Mr. Hancock's manufactory.

Fig. 2 exhibits the cutting part of the instrument separately, on an enlarged scale, with the lowermost portion in section: the tenon, *i*, is inserted into a cavity in the screw, *e*, fig. 1, and made fast by a cross pin which goes through both; by this arrangement the instruments may be readily exchanged for others of different dimensions; the lower extremity of this revolving piece is formed into a centre bit, *m*, which owing to the collars, *n n*, cannot ascend or descend without the square instrument, which accurately cuts out the angles beyond the range of the circular incision made by the former.

The square cutting tool is made of a bar of steel, with a hole drilled out of the solid, in the manner shown by the end view, fig. 3, and the edges are then formed by filing and grinding them to the bevil or angles shown in section by fig. 2. Fig. 4 represents a similar view of the end of the instrument, but with the centre bit in its place.

It will be readily perceived that a *square* tool, by repeating the incisions side by side close together, may be made to produce a mortice of the figure of *any* rectangular parallelogram, or, as workmen would say, an *oblong mortice*, of any length or breadth larger than the instrument employed. The same effect may likewise be produced by a single operation; by arranging a series of centre bits, or circular

cutters, side by side, with toothed wheels at their upper extremities, or axes, taking into one another so that they shall cut simultaneously, a single external angular cutter, embracing all the centre bits, would then suffice for that purpose.

In like manner any acute or obtuse-angled figure, any polygon, or any figure with curved sides, might be made of any size whatever.

By the construction of the present model, it would be necessary in changing the tool to change also the guide piece through which it slides. The screwing and unscrewing of the guides may, however, be avoided, by having tenons in the latter of an uniform size, to fit into a mortice in the upright iron frame; and in manufactories where a great variety of mortices have to be made, we would with submission suggest another mode, in which the trouble of changing the guides would be still less: it is to have *a guide wheel*, turning horizontally on the upright bar, *a*, as its axis; on the circumference of the wheel should be made a series of apertures, corresponding with the form of the tools and of the mortices required. By this arrangement, indeed, most of the tools might be left in the guide wheel, ready to bring any one of them into action under the screw, by just turning the wheel round. Other modifications might be made to suit particular purposes, but we will not fatigue our readers by their explanation; being confident likewise, that the ingenious inventor would, if consulted, readily supply whatever adaptations might be required, with better arrangements than we can devise.\*

It does not appear to us that the employment of this machine would suit the private workman, unless it was in a branch of business where a great number of mortices were required of one size; in *manufactories*, however, where this is the case, its advantages would soon be felt; no skill being required in using it, a boy, a perfect novice, may by its aid execute the work quite as well as the experienced workman, and with his eyes shut. *Chair-makers* would, we think, find it a useful appendage to their workshop, for making their mortices with greater accuracy and rapidity, and consequently render the chairs more firm and durable; as most of their mortices have to be made in a slanting direction, a cradle should be attached to the machine for enabling them to change the direction of the perforations. We do not see why such a machine could not be successfully employed by *wheelwrights*, in making mortices in the naves of wheels for the reception of the spokes. In the large workshops of *carpenters and builders* it might be extensively used in dispatching a great deal of heavy framing; and in such work, particularly the making of framed doors, the machine might be so constructed as to perform the offices both of a mortice borer, and of a cramp to draw the jointed parts of

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\* Since writing the foregoing we have been informed that Messrs. Alexander Christie and Co. engineers and steam engine manufacturers, of Sheffield, have undertaken to make these Boring Machines. We are happy to learn this, as persons desirous of possessing them may get them manufactured in a style of workmanship that will ensure their excellent operation: the London Agent is, we believe, Mr. Hoole, of Adde Street, Wood Street, Cheapside, through whom, of course, the machines may be procured.

the work into close contact. *Millwrights* might save a great deal of time and labour by the use of the machine; in short, it would prove of great utility in every mechanical operation, in which many mortice holes are required.

In Mr. Branch's instrument it appears to us that the operation must be very unsteady when compared to that of Mr. Hancock's; and we cannot conceive how the little central entering screw can have sufficient power to draw the instrument into the wood, and consequently, that a great deal of inconvenient direct pressure must be given at the same time that it is forced round laterally; and if the whole instrument does not perforate at every turn a depth equal to the distance between the threads of the entering screw, the latter is of no assistance whatever. To work with two or more such square augers at a time, side by side, as mentioned in the American account, with workmanlike precision, and unaided by any other mechanical arrangement, would, we think, require the strength of a Hercules; that of an ordinary man we feel assured is unequal to it. Mr. Hancock's machine being a fixture, its motions are steadied and regulated by the revolutions of a screw, which passing through a fixed nut, confers upon it all the powers of the screw press, and it cannot fail to make its perforations with a certain and uniform progress.

We ought not to close this account without mentioning Mr. Hancock's method of making the tenons to his mortices, the fitting of which is so accurate and tight as seemingly to restore to the wood its former state of solidity. They are cut out by means of two circular saws in a lathe, placed at a distance apart equal to that of the sides of the mortice: by this means they must obviously be formed with great truth and facility.

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## DESCRIPTION OF A STATICAL HYDRAULIC ENGINE,

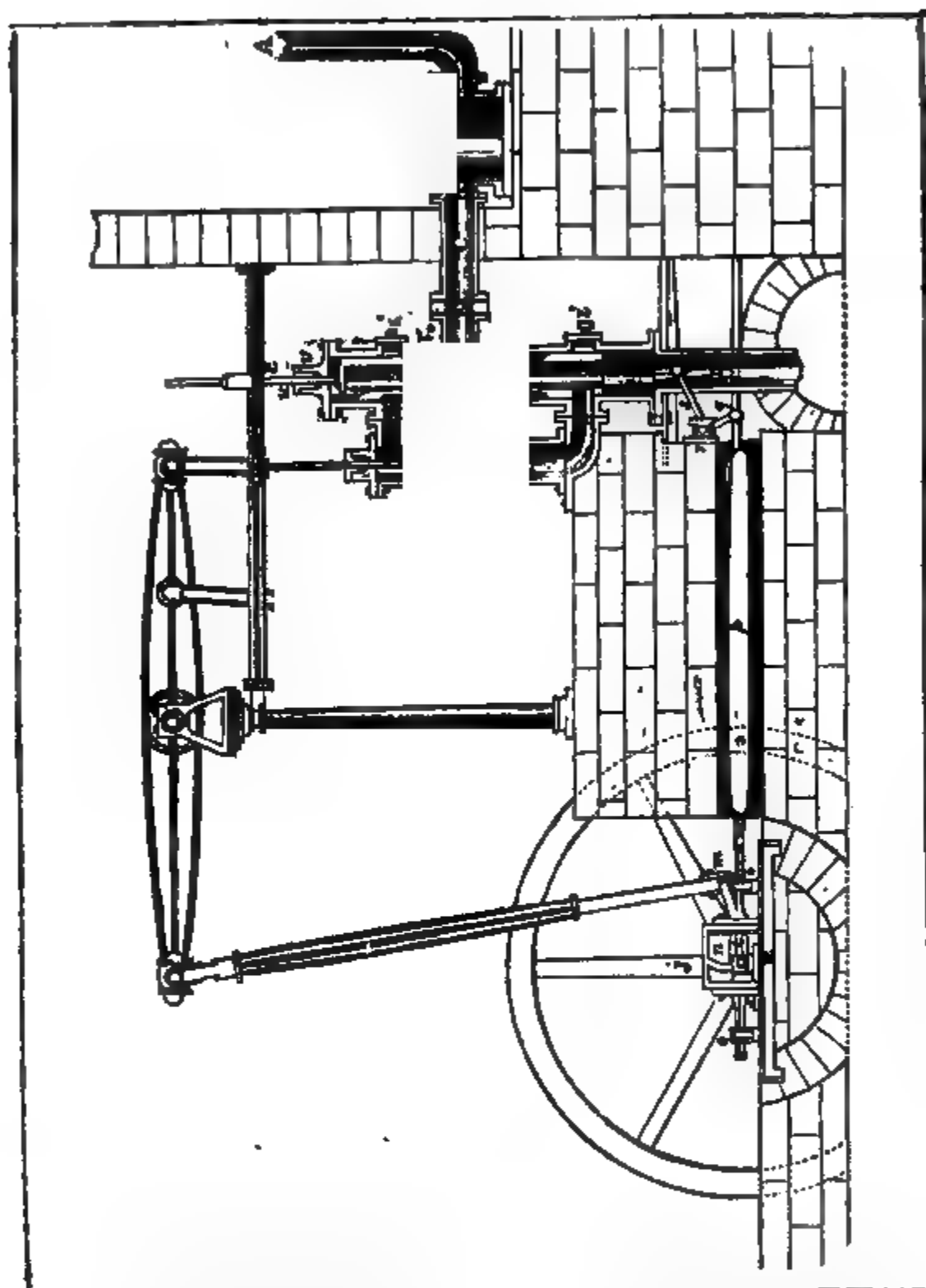
Erected by Mr. MANWARING, at Messrs. COOK and Co's Alum Works, near WHITBY.

(*From the Transactions of the Society of Arts.*)

In the common steam engine, the prime mover is a piston-rod, alternately rising and falling in a cylinder, in consequence of the elasticity of steam let into the cylinder, alternately above and below the piston.

In the statical hydraulic engine the prime mover is exactly the same as in the steam engine; but the motion given to the piston rod is by means of the statical pressure of a column of water, applied alternately above and below the piston.

The annexed figure is a representation of the engine: A is the pipe by which the supply of water is brought from a head 170 feet above the engine; B is a vessel containing air, the continual elastic pressure of which prevents the blow that would otherwise be occasioned by the descent of the water; c is a throttle valve; d d is a hollow open cylinder, working within an exterior one, and closely



applied to that cylinder at the parts *c c*, *c c*, but elsewhere leaving a vacant space between the two cylinders for the reception of the water; *h h* are packings in order to prevent the escape of the water between the two cylinders; and *i i* are adjusting screws to tighten the packing in proportion as it is worn away: *f f* are two passages that lead into the upper and lower ends of the pipe *g*, in which the piston *w* works.

When the cylinder *d d* is in the position represented in the plate, the communication is open, by means of the upper pipe *f*, for the water to flow into the pipe *g*, above the piston *w*; at the

same time the passage is open for the water in the cylinder *g*, below the piston, to flow out through the lower pipe *f*, and through the lower part of the open cylinder *d*, into the pipe *x*, which is somewhat more than 30 feet long, and terminates in a cistern of water. There is, therefore, above the piston *w*, a hydrostatic pressure equal to 170 feet of water, and below it a partial vacuum; the piston consequently descends to the bottom of the pipe *g*. By the time that it has arrived in this position, the cylinder *d* will also have descended so far as to have opened the communication between the entering water and the lower pipe *f*, and to have shut off its communication with the upper pipe *f*; the hydrostatic pressure is therefore transferred to the under part of the piston, which consequently rises, while the water above the piston pours into the top of the cylinder *d*, and escapes through the pipe *x*.

The alternate motion of the slide or cylinder *d* is thus effected. The rod of the piston *w* is attached at its top to one end of the beam; at the other end of the beam is a rod, terminating below in the crank *m*: the oscillating motion of this crank is transferred, by means of the connecting bar *l*, to the axis *k*, on which is placed the curved tooth or cam *n*: the latter is inclosed within the rectangular frame (or cam box) *j*, and being moveable in a horizontal position, is consequently made to perform a backward and forward motion, by the cam pressing first on one, and then on the other side of the box. To the outside of the box are fixed two guide bars, supported on the bearings *o o*: the connecting rod *p* at one end to the guide bar, and at the other end to the arm *q* of a bent lever, having for its fulcrum the pivot *r*: the other end of the lever is forked, and embraces the pipe *x*: one of these forks *s* is connected with the lower end of the upright rod *t*, and the other fork is connected with a similar rod. These rods are fastened at top to the two ends of a cross bar, to the middle of which is fixed the rod *u*, which works in the stuffing box *v*, and gives motion to the slide *d*.

The slide remains stationary nearly half a stroke of the piston, in order to allow the water to act with its full force, and this is effected by its being necessary for the cam, after it has moved the box in one direction, to perform about a quarter of a revolution, before it can act on the opposite side of the box.

The reason for making the passages *ff* as large as represented is, to diminish as much as possible the friction of the water, which otherwise would retard the motion of the piston.

The thanks of the Society were voted to Mr. Manwaring, (Engineer, of Marsh Place, Lambeth,) for the drawing of this engine, with permission to publish a description of it.



## FENNER'S PATENT APPARATUS FOR CURING SMOKY CHIMNIES.

THIS invention consists in the application of a spiral tube or flue to the upper part of an ordinary chimney, for the purpose of increasing the draft, and by the direction thus given to the smoke to prevent any re-action of the current down the chimney.

The figure in the margin exhibits a section of a chimney, with one of these spiral tubes, inserted in its upper part. These tubes are made of thin copper, and are furnished with a flange at the lowest end, upon which it rests, on the top of the brick work of the ordinary flue. The chimney is then continued upwards with a reduced thickness of brickwork, by which means its capacity is sufficiently enlarged for the reception of the spiral tube. The expanded part of the chimney is closed in at top, so as to form a hot-air chamber round the tube; and as the latter is made of thin metal, the heat is readily transmitted through it into the chamber. The effect of these arrangements, as might be expected, is beneficial, which has indeed been proved by experience: the following fact proves the utility of the apparatus more than any argument.

The town of Hastings consists for the most part of one long narrow street, situated at the bottom of a deep ravine; in the middle of this street is a house, belonging to a Mr. James Breeds, (one of the most respectable inhabitants of the place,) in which there is a chimney that had returned its smoke for more than 30 years, notwithstanding every sort of contrivance, both at the top and at the bottom of the flue had been tried in vain. Resolved, if possible, to get rid of the nuisance, Mr. Breeds made the experiment with Mr. Fenner's apparatus during the last autumn; it succeeded to perfection: the appendage is retained, and the chimney has not returned any smoke since, notwithstanding the unusually stormy weather of the last winter.

The patentee considers this effect to be mainly attributable to the

smoke passing through a *spiral* tube, which, he says in his specification, gives "a better direction to the smoke;" we mention this by the way, as we may be wrong in disagreeing with him; and it perhaps matters little what is the immediate cause, so that a good effect be produced. The spiral tube presenting greater impediments to the descent of a blast of air than a vertical one, is in our opinion, one of the causes: again, a *longer* flue is obtained by a spiral than by a straight tube, consequently the draught is increased from that circumstance, and the pressure of the external atmosphere more easily overcome: to this second cause may be added a third; the hot-air chamber rarefying the air within the tube, tends, also, much to increase the draught.

With respect to sweeping such a flue, the spiral form is far better adapted than the common, for the ascent of the ordinary machine used for the purpose; and it has been found that the small quantity of soot which lodges in the spiral loses its adhesive property, and becomes a fine light dry powder that may be easily blown away. In chimnies that are perfectly free from bond timber, (which is rather unusual) a fire made of wood shavings serves to cleanse the flue thoroughly. The patentee, Mr. William Fenner, of N<sup>o</sup>. 11, Fitzroy Place, New Road, is a carpenter and builder, and he proposes in building chimnies, to make the brick-work of the lower part fire-proof, with his spiral flue above, when they may be cleansed by burning out, instead of sweeping, in situations where it may be desirable. The number of coils or turns in a spiral are regulated according to circumstances, and the draught required.

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### London Mechanics' Institution.

Dr. BRKBECK, the learned president of this Institution, has commenced the delivery of his promised course of Lectures on the Structure and Functions of the Human Body; a subject which is in itself of such vital importance, that the Theatre has been crowded to an overflow during the whole of the four Lectures hitherto given. In these Lectures the Doctor has minutely explained the construction of the skeleton or frame-work of the body, to illustrate which, two human skeletons, with all the separate bones, and a variety of skeletons of inferior animals, have been exhibited.

The next lecture will be devoted to explain the situation and uses of the *muscles* of the body; on which occasion the *natural subject* will be exhibited and referred to, as being decidedly preferable to the employment of *casts and diagrams*.

The worthy Doctor kindly offered to proceed by *either* method of elucidation, though he recommended the first-mentioned as the best calculated for that purpose, if the members felt that they could overcome the very natural repugnance which existed to the exhibition and dissection of the human body. The audience, by receiving the proposition with loud and reiterated applause, plainly expressed a unanimous desire to embrace the valuable opportunity thus offered to their acceptance, of becoming acquainted with the structure of the

human body, in the only way in which that object can be effectually accomplished.

On Wednesday, the 9th of May, Mr. KERNY completed his course of Lectures on the Steam Engine; and after having pointed out a geometrical method of constructing the parallel motion, he announced to the members, that to put them fully in possession of this method he should send copies of it to the London Mechanics' Register, and also to the *Register of Arts*, (*which will appear in our next.*)

On Wednesday last, the 23rd, Wm. STONE, Esq. of Deptford Dock Yard, commenced a course of Three Lectures on the STABILITY OF FLOATING BODIES.

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## History of the Steam Engine, Chap. VI.

*Continued from p. 464.*

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There is great ingenuity displayed in the formation of this machine, and the whole shows much mechanical ability; nevertheless there are defects of a sufficiently prominent nature to account for its failure; The very common fault of great friction, arising from the use of the revolving plates, is here a difficulty which we conceive could not be readily overcome; but the principal cause would be leakage, arising from the impossibility of keeping the rubbing surfaces steam-tight. This leakage would take place principally in the part where the sliders should be in contact with the central plate; it appears to us that the rapid motion of the slider must necessarily cause it to rebound from the plate, and leave an open space for the escape of the steam; we also apprehend that the surfaces of each slider would in a short time become so irregularly worn, that it would not fit its seat on the surface of the groove, for the top and bottom of the slider is constantly in contact with the surface of the groove during the whole of its motion, whilst the sides (speaking relatively, for there can be neither tops nor sides of a circle) are merely in contact at the time the slider is moving through a space equal to the depth of the groove. This will produce a greater wear on one part of the slider than another, and of course, in time, cause the joint to allow an escape of steam.

Another fault in this machine is, that the mode of working the sliders by means of the semi-circular rods is a very insecure method; and from the indirect application of the power necessary to work them there is a constant danger of bending the rods, and, consequently, leaving the slider in the groove. If this were to happen, the piston in its revolution would come violently in contact with the slider, and most likely cut it in two, or otherwise injure it and the rest of the engine beyond repair.\*

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\* The author of Stuart's History of the Steam Engine states—"that the general arrangement of the parts and manner of action of this engine resembles Mr. Mead's." This apology for omitting the ingenious apparatus of Mr. Mead is singular enough, since no two machines we have described can differ much more than these.

A patent was obtained by Mr. Joshua Rontledge, of Bolton-le-Moor, in the year 1818, for a Rotative Engine, of which the accompanying drawing is a section, and may be thus explained.

Suppose the steam-stop C, and the lever H  $\delta$ , to be properly packed in the situation represented by the drawing, so that the steam cannot escape past either one or the other, it will be evident that if the steam is admitted through the pipe G into the space M, the lever H  $\delta$  will be propelled forward towards C through the space Q, until the sloping part H comes in contact with the lower point of the steam stop C, which will then turn upon a steam-tight joint or centre O, and rise up into the box or chamber D until the lever H  $\delta$  has passed by. The pressure of the steam then compels the stop C to follow the lever down the inclined plane  $\delta$ , until it comes into its former resting place, where it remains stationary upon the cylindrical part of the lever, as seen in the drawing, until again raised by the sloping part H as before. During the time that the point H  $\delta$  is passing the steam-stop C, the steam that had last carried the lever round makes its escape through the pipe B, either into the open air or into a condenser, and new steam is again instantly admitted, and so on continually. When the engine is thus constructed with only one arm or lever, there is about one-tenth of the circle or revolution where the steam has no power; the motion of the engine is then kept up by the velocity already given to the fly-wheel; but when two arms or levers are used, as in large engines, then the steam is made to act with equal force through the whole of the revolution.

A patent was obtained in the year 1818 for a Rotative Engine,

by Mr. John Malam, of Westminster, which in its general principle resembles those of Messrs. Cartwright, Chapman, and Roulledge: the details, however, somewhat differ therefrom. The main point of difference is, that Mr. Malam proposes to cause his external cylinder to revolve and leave the interior one at rest. This he proposes to effect by using a "leaden piston," which by its weight will always remain at or near the lowest part of the circle, whilst the steam acts upon valves or flaps which, after they pass the piston, open out and receive the action of the steam. There are three of such valves, which are exactly the same as those used in the engines of the persons just mentioned, and operate in the same way. The piston consists of a heavy block of lead, fitted exactly by packing or otherwise to the cylinder; and the whole apparatus differs so little in other respects from those, that it is apprehended no further description will be necessary. The motive of the patentee in causing the external cylinder to revolve was evidently to avoid the inequality of wear which may arise from fixing the external cylinder, and making the internal parts to revolve; for, in the latter method, the axis and machinery attached to it have a tendency to wear downwards by gravitation, and get out of truth; this would in time cause the cylinder to assume an oval form, and thereby render it difficult to be kept tight by packing, and this (it should be observed by the way) has been considered as one objection among the many urged against rotative engines, though, perhaps, if every other could be overcome, this, on account of the length of time which must elapse before it could occasion a serious inconvenience, would not operate to prevent the successful application of such an engine.

But it must appear to all that the patentee's plan of obviating this evil is but a clumsy and ill-contrived one. The valves out of the question (the faults of which have been already explained) we cannot for a moment think that the weight or piston could afford an abutment of sufficient firmness and steadiness to produce any regular and equable motion; indeed, we doubt whether any weight placed as this was, could remain stationary whilst passing over the inequalities of such a cylinder, and enduring the varied force of the steam upon the changing of the valves. There can be little doubt but that it would vibrate to and fro as each valve opened and shut, and thereby destroy as much power by reciprocation as any beam engine ever known.

The same specification likewise contains a description of another rotative engine, in which the abutment consists of mercury, water, or fusible metal, such as lead and bismuth. In this engine there are three drums, the exterior one forms a casing or jacket to the second, and is kept heated by steam or hot air. These two outer drums are stationary, whilst the inner one revolves upon its axis, one end of which is tubular for the admission of the steam. There are attached to the moving cylinder certain curved partitions, which form chambers something like the buckets of a water wheel. The steam being introduced through the hollow axle, after filling the inner cylinder, flows into one of the compartments formed by the curved partition,

and pressing upon the fluid, causes the drum to rise on that side and revolve upon its axle; this suffers the steam to enter the compartment underneath the first, (in a manner not clearly described) and force it out of the fluid. The first compartment is by this time above the level of the fluid, and the steam at liberty to escape into the channel above, which communicates with a condenser or the open air. The chambers are thus filled with steam, and raised in succession above the surface of the fluid, and produce a constant rotation of the axis.

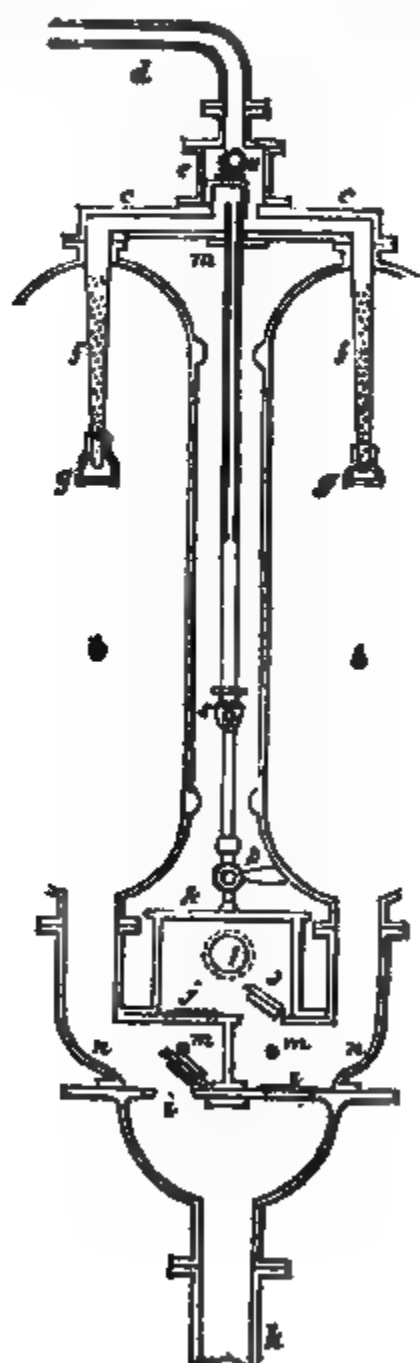
This latter scheme differs little from the Steam Wheel of Sir W. Congreve, which is simply an overshot wheel completely immersed in some liquid in which it is made to revolve by the introduction of steam underneath the inverted buckets, which by displacing the water with which they are filled, renders one side of the wheel buoyant, and causes it to ascend. By this means the buckets are successively brought above the induction pipe and filled with steam, which continues the buoyancy of the ascending side, and keeps up a constant revolution of the axis. The steam in the buckets is discharged into the air as soon as they have reached the surface of the fluid, the latter then entering them and occupying the place of the steam.

Neither of these schemes are sufficiently meritorious to demand much consideration, and only deserve notice because they have engaged the attention of highly-talented individuals. (Among these we do not mean to include Sir Wm. Congreve; for whatever may be his qualifications in other respects, he has displayed but little talent in his attempts to improve the steam engine, and even in this scheme must yield the priority of idea to Mr. Malam.) Mr. Bryan Donkin and Mr. Malam have both tried the same plan, and found that the effect bore a very small proportion to the steam expended. This was mainly attributed, in the water engine, to the large quantity of exposed liquid which is to be maintained at a temperature equal to that of the steam, and to the difficulty of getting the steam into the buckets without allowing a considerable portion of it to escape through the water without at all aiding the revolution of the wheel. An insuperable difficulty also was encountered regarding the temperature of the water, for if the water were below the boiling point, a great portion of the steam was condensed, and if at or above that temperature, the water was speedily dissipated in vapour, and required to be replenished by more water, which, if not sufficiently hot, again produced condensation, but if it were used boiling-hot, a separate boiler was necessary to supply the reservoir.

Any one of these difficulties, however, we apprehend would be sufficient to prevent success, and this may account for the failure of the mercury engine of Mr. Malam, in which it appears that the great evil would be the steam wasted, by escaping past the sides of the compartments; for without the nicest regulation of the supply of the steam, not one half of it would take its place in the bucket, owing to the facility with which it might displace the mercury and rush through it to the surface, and so to the eduction pipe. We are not able to speak as to the oxidization which would take place on the

mercury when exposed to constant heat, but we apprehend this would be very considerable, and of course add to the defects of the plan.

We described in an earlier part of this work a very simple modification of Savery's plan of raising water in the engine of Mr. Nuncarrow; and from the great simplicity of another apparatus, on the like principle, we are induced to give an account of it. We allude to the machine of Mr. Pontifex, of Shoe Lane, London, whose improvement consists, it will be seen, in rendering the machine a self-acting one; but besides this, the skilful arrangement of the parts, and the precision and certainty of its movements, makes it an object worthy of attention.



"*b b* are two steam cylinders connected by cross tubes at *c c*, in each of which a vacuum is alternately formed by the condensation of

elastic vapour, connected from the boiler by the bent tube *d*, and admitted to the steam cylinders by means of the sliding valve, *v*. *ff* two tubes perforated with small holes for the admission of steam and injection water, the latter of which is distributed by falling on the strap, *g*. *h* the suction pipe, proceeding to the bottom of the well, which in no case ought to exceed from twenty-eight to thirty feet in depth; so that a vacuum being formed in the copper vessels, *b b*, the water will be raised by the pressure of the atmosphere, and passing up the tube, *h*, will take the place of the elastic vapour. *ii* two valves placed at the upper end of the suction pipe, *h*, which allow of the upper passage of the water from the well, but prevent its return. *jj* two similar valves, opening into the air vessel, *k*, to which is attached the nozzle, *l*, serving to convey the water from the copper vessels to any required point. *m* the injection tube, furnished with a valve, and intended to convey water from the box, *n*, to the taper tubes, *ff*. *p* stop cock to regulate the supply of condensing water. There is a tube passing from the bottom of the cistern, *n*, to the injection tube, *m*, and furnished with a stop-cock at *s*. To put this engine in action the steam must be first raised to the boiling point, and the valve or cock opened, which admits it to pass from the boiler to the pipe *d*. One of the buckets must now be made to descend, which will open the sliding valve, *e*, and admit the steam into the cylinder, *b l*. The atmospheric air, which will thus be expelled from the cylinder, is allowed to pass through the valve, *j*, and nozzle *l*. The other bucket must then be depressed, and by its action upon the sliding valve it will open a communication for the injection water through the pipe, *q q*, which passing down the perforated tube, *f*, will immediately condense the steam, and form a vacuum in the vessel. The whole pressure of the atmosphere being now removed from the suction pipe, *h*, the water will rush up to restore equilibrium, and the vessel, *b*, being filled will furnish a supply at the bent tube, *l*.

“ Having examined the action on one half of the apparatus, we may suppose the same effect to be produced on the opposite side: The steam will, in the first instance, be admitted by the pipe, *c*, and a communication afterwards opened by means of the sliding valve with the condensing water, which by reducing the steam to its original bulk, will form a vacuum, and the water will again ascend as in the first vessel. The stop-cock, *y*, must now be opened, and the bucket, *x*, (first described) made to descend, which will remove the sliding valve, *e*, to its original position, and admit the steam to the upper part of the first vessel, which will depress the water and cause it to flow through the valve, *j*, and nozzle, *l*, while at the same time the water will pass through the tube, *u u*, in which the valve, *w*, is inserted beneath the inverted vessel, *v*. The water will continue to enter the bucket, *x*, till its increasing weight causes it to preponderate, and turn the sliding valve, *e*, in the opposite direction. Should there not be sufficient supply of water in the cistern, *rr*, for the purpose of condensing the steam in the larger vessels, the stop-cock, *p*, must be opened, and additional supply of water will then be fur-

nished from the chambers, *a a*, by the tube, *m*; and in the event of the bucket not being depressed at the instant that the water is expelled from the chamber, *a*, of the vessel, *b*, the steam will pass through the tube, *u u*, and act between the under side of the fixed inverted vessel, *v*, and the surface of the water in the moveable bucket, *x*, the descent of the bucket being accelerated by the repellent force of the steam, so that, by the alternate action of the buckets, *x x*, the motion of the engine is rendered continuous.

"It appears that each steam vessel in the engine employed at the City Gas Works, contains about 36 gallons of water, which is raised about 28 feet three times every two minutes; one bushel of coals, or two of coke, serving the boiler about two hours and three-quarters."\*

*(To be continued.)*

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\* Partington's History of the Steam Engine.

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### LIST OF NEW PATENTS SEALED, 1827.

**SMELTING ORES.**—To A. F. Mornay, of Ashburton House, Putney Heath, Esq. for improvements in smelting ores. 27 March. Six Months to enrol specification.

**CALICO PRINTING.**—To Matthew Bush, near Bonhill, by Dunbarton, North Britain, for improved Machinery for printing calico and other fabrics. 27 March. Six Months.

**CLOTH MANUFACTURE.**—To Bennett Woodcroft, of Manchester, for certain processes and apparatus for printing and preparing for manufacture, yarns of linen, cotton, silk, &c. 31 March. Six Months.

**PLOUGHS.**—To H. A. Stothert, of Bath, for improvements on ploughs. 4 April. Six Months.

**POWER LOOMS.**—To John P. Reid, Glasgow, for improvements on power looms. 4 April. Six Months.

**SALT-PANS.**—To Joseph Tilt, of Prospect Place, Southwark, Surrey, for improvements in the boilers or pans, used in the preparation of salt. 4 April. Six Months.

**PRINTING MUSIC.**—To Edward Cowper, of Lambeth, Surrey, for improvements in printing music. 5 April. Six Months.

**GRAND PIANO-FORTES.**—To John Spode Broadwood, of Great Pulteney Street, Westminster, for improvements on grand piano-fortes. 9 April. Six Months.

### TO OUR READERS AND CORRESPONDENTS.

Mr. PERKINS's paper "on the economy of using highly elastic steam expansively," promised in our last, is unavoidably deferred; but we shall shortly give it insertion, together with a description of his Beat Engine, on a new patent principle.

We have received a very excellent plan for preventing the recurrence of any accident from inundation in the Thames Tunnel, in the future progress of that interesting and stupendous work, which will be given in our next with engravings.

The high-pressure engine mentioned by J. W. is certainly a very complete one; it will shortly appear,—probably in our next.

ALCONON's paper has been received: we think it will require rectification.

W. W. and AN ENQUIRER, are intended for insertion at the earliest opportunity.

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# REGISTER

OR

## THE ARTS AND SCIENCES.

No. 103.] SATURDAY, JUNE 9, 1827. [Price 4d.

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CHRISTIE & CO.'S PORTABLE HIGH-PRESSURE  
ENGINE.

**PORTABLE HIGH-PRESSURE ENGINE,**

By A. CHRISTIE &amp; Co. Engineers, Sheffield.

Manchester, 22d May, 1827.

Mr. Editor,

Having an opportunity of sending this to London free of expense, I take the liberty of informing you, that the Register of Arts, though excellent in its kind, and containing information respecting steam engines, much more extensive and important than any of the other periodicals, is deficient, nay, almost silent, on the very points upon which I wish for information. I am about to commence the manufacture of an article on a small scale, in which I shall require a steam engine of between 3 and 4-horse power. I am particularly desirous to have an engine of the most improved construction, and one which will occupy but very little room. Now my object in troubling you, Sir, with this communication is, to inquire whose engine will best answer my purpose, and of whom, and at what rate, it can be procured. It appears to me, that the engine which you described in N<sup>o</sup>. 97, which had been employed at the London Docks in pumping water, would answer my purpose; or probably Perkins's, or Mr. James's, if either of them has been tried at actual work, would be preferable, as occupying less space. But, Mr. Editor, I have neither money nor inclination to try experiments, or to carry into practice the theoretical schemes of any projector, and therefore I am determined not to order an engine, except such as had been some time in use, and manufactured by persons experienced in their construction, for I cannot give much attention to it while in use, and frequent repairs would be attended with much inconvenience to me. Now your information on these matters will greatly oblige me, and I doubt not, many of your other readers. I would suggest to you at the same time, whenever you describe an engine, to state the room which will be occupied by a 5 or a 10-horse power, or any other of which you can procure the dimensions.

I am, Sir, Your obedient Servant.

J. J. TAYLOR.

PREVIOUS to the receipt of the foregoing Letter we were somewhat perplexed in the selection of a leading subject for our present number; notwithstanding we had several new, and we may add, highly ingenious inventions before us; but not being able to discover their practical advantages quite so readily as the inventors, we were anxious on the one hand to avoid making any unfavourable observations upon them, and on the other, not to load our columns with subjects of questionable utility. We therefore readily adopt the suggestion of our correspondent by supplying the deficiency pointed out by him in our work.

One of the most compact and effective engines we ever saw is at Mr. Burdekin's Anvil Manufactory, Vulcan Works, Sheffield, which may be considered as the model (with slight variations) of many others constructed by Messrs. Alexander Christie and Co. engineers, of Sheffield, and set up by them in that town, and at various works in the neighbourhood. This engine is remarkable for its extreme

simplicity, while it embraces the best modification of every improvement that experience has proved to be advantageous. It is a non-condensing or high-pressure engine, on a portable plan, and is calculated at only two-horse power, though from the quantity of work it performs constantly we should have supposed it to exert a much greater power. It is employed in working three pairs of large bellows, and in turning an enormous grindstone, used for grinding the faces of anvils; and when it is considered that anvils, weighing nearly 800 lbs. each, are frequently made at the fires blown by this engine, and ground by this stone, some idea of the powerful effects produced by only a seven-inch cylinder may be formed. The engine is worked 66 hours each week, and consumes one ton of small coal or culm, (value on the spot 5s. 4d.) and 1200 gallons of water in that time. The pressure on the safety valve never exceeds 30 lbs. on the square inch; the boiler is wrought of the best Yorkshire iron, three-eighths of an inch thick, and well rivetted.

*Reference to Engravings*—Fig. 1 represents a side view of the engine, with the gearing to work the bellows, and an edge view of the grindstone. Fig. 2 represents a front elevation of the engine, and Fig. 3 a transverse section of the boiler and furnace.

A the furnace door; B the furnace; C the ash pit; D the boiler; E the stone float (shown in dotted lines) for regulating the supply of water to the boiler; G a counterbalance to the float; F a flue, returning the flame and heated air through the boiler; H the steam pipe, in which is fixed the throttle valve I; near the side pipe K, in which work the slide valves L L, moved by the rod N, attached to the eccentric O, on the fly wheel shaft W; M M M are brass stuffing boxes; P the upper steam entrance; Q the cylinder; R the piston rod, working through the bridge A 1, and communicating with the crank T, by the side rods S S, forming a very simple and beautiful parallel motion; V the crank pedestal to support one end of the fly wheel shaft; X a pair of bevil wheels to work the governor Y, by the expansion and closing of the arms of which the brass collar Z is raised or depressed, and acts on the valve I, through the lever 1, and handle 2; 3 an arm, extended from the metal cheek 9, containing at the extremity a brass bush in which the top of the governor spindle revolves; 4 the pump for supplying the boiler, through a feed pipe, (not shown) worked by the rod 5, and eccentric 6; 7 the fly wheel, the periphery of which is round in its transverse section, and of cast iron; the arms or radii are of wrought iron, and are inserted into the former while casting; 8 a carriage, to support the pedestal for the shaft 15, used for working the bellows before-mentioned; 9 9 metal cheeks for supporting the pedestals for fly wheel shaft: 10 a metal foundation plate, under which is a small cistern (not shown) containing a day's consumption of water for the boiler; 11, 11, 11 gearing for

the grindstone 12, running in a metal trough 13; 14 14, gearing for the bellows, worked by eccentrics on the shaft 15.

At the bottom of the side pipe is an eduction pipe (not shown), from which the steam is discharged into the cistern to heat the water for supplying the boiler, when it (the steam) has performed its office in the cylinder.

Having explained the construction and uses of the several parts of the engine consecutively, it will be needless, we presume, to describe the general operation; we shall therefore merely notice that the advantages possessed by this form of engine are, *comparative economy, both as respects first cost, (which does not exceed two-thirds of that of a condensing engine of the same power) and as respects the consumption of fuel: from the fewness of its parts, and the simplicity of their arrangement, less attendance is necessary, and the machine is subject to less friction; it is adapted to situations where sufficient water cannot be obtained for a condensing engine; and the power necessarily consumed in raising water for condensation and working the air pump in the common engines, is entirely saved.*

It is, perhaps, worthy of observation that the disposition of things at Sheffield peculiarly adapts it for the construction of steam engines with economy; her soil yields coal, and iron of excellent quality; the genius of her people has, for a long series of years, been almost exclusively devoted to the preparation of the most delicate, as well as the most massive, iron and steel work, the unrivalled excellence of which has been mainly brought about by the minute division of labour, aided by superior and powerful machinery. Such are the facilities possessed by the town of Sheffield in this respect, that we have heard it stated, and we doubt not correctly, that smooth, bright, and polished iron work of the best quality, can there be produced at a less cost than the rough forge work of most other places.

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#### A PLAN FOR PREVENTING WATER FROM BREAKING INTO TUNNELS UNDER THE BEDS OF RIVERS, BY MR. GARVEY.

*To the Editor.*

SIR,

WHILE reading in the public prints of last week an account of an accident occurring at the Tunnel now in progress under the Thames at Rotherhithe, by the water breaking into it, the following plan of preventing such accidents in future to works of that nature, carrying on under the beds of rivers, suggested itself to me, which might be carried into operation at a moderate expense, and which appears perfectly adequate to remedy the present difficulty, and to prevent the occurrence of such accidents in all similar cases.

The plan consists in placing in the bottom of the river, directly over the part undergoing excavation, a large platform or raft, with ledges proceeding downwards to fix into the soil, to prevent the water from entering the excavation.

The nature and operation of this will be understood by reference

to the accompanying drawing, where S S represents a section of the tunnel; R the mud, gravel, &c. constituting the bed of the river; A B the square platform, about twice the width of the tunnel, consisting of two layers of planks crossing each other at right angles, and made water and air-tight by a stratum of artificial leather, tarpaulin, or other elastic water-proof material, between the layers; G G and H H represent sections of the ledges or rims, which may be made of iron, or wood pointed with iron; the platform must be loaded sufficiently to sink in water; F is a pipe for the escape of the air while the platform is descending in the water; and E is a pump to draw off the water from under it when it reaches the bottom; *vv* are

sliding valves, to be opened or shut at pleasure by the cords passing over the pulleys *m m* and *n n*; the bent pipes, *i i*, are for the escape of the air or water from the space between the ledges *G* and *H*. When the apparatus is put down to the bottom of the river the water is to be removed from underneath by the pump *E*, which will produce a very great hydrostatic and pneumatic pressure on its surface, and cause the points of the ledges, *G* and *H*, to penetrate the bed of the river, and the whole to become firmly fixed in its place. The cavity *M*, which extends of course all round the raft, is made conical, for the purpose of compressing the soil between the rims as they are forced down, and thus preventing the entrance of the water at the edges.

When the apparatus is to be moved forward to a new station the pump *E* is to be converted into a condensing air pump by changing the valves; and air is to be forced under the raft till it is disengaged from the bottom, when it can with facility be moved forward in the water and sunk as before.

When the bed of the river is very irregular and gravelly it may be necessary to dredge it, and put down clay in some parts before the platform is brought to its place.

Should you consider this worthy insertion in your truly useful work it is much at your service.

32, Ogle Street.

I am, Sir, your obedient Servant,

MAURICE GARVEY.

*[It is due to the ingenious author of the foregoing admirable contrivance to state, that we received his Communication prior to the publication of our last number, (viz. on the 22nd of May,) as another and somewhat similar plan was proposed about a week afterwards, by a correspondent in the Times Newspaper; the last-mentioned plan was, however, very incomplete, which we think cannot be said of Mr. Garvey's.]*  
—EDITOR.

### "THE GLORIOUS UNCERTAINTY OF LAW."

It was not our intention to have occupied our pages, with any further notice of the litigation, into which we have been forced by our liberal contemporary, Mr. Newton, had not the conclusion of the points at issue, been erroneously reported in the newspapers. These mis-statements seem to require a little correction on our part, after which, we purpose dropping the subject altogether.

We have already, in our 97th number, explained the circumstances of the action, and its result, by which a jury gave it as their opinion, that we had availed ourselves of our contemporary's Journal, in making copies from it, of four engraved diagrams. The absurdity of this verdict was apparent to every body, but the jury that tried it. Of their gross ignorance of matters of the kind, and consequently of their utter incapacity to try questions of that nature, our readers, and every body present in court, will recollect a most remarkable proof, which was afforded by their utterance of so curious an observation, that it deserves recording, at least twice over. It was pointed out to them by our counsel in one of the drawings, that a pipe which was employed to convey steam into a vessel, was represented by Mr. Newton as closed at the end, consequently rendering the machine of no use, while we had drawn the end open, according to the original, from which both drawings were professedly copied: yet ours, that was right, they found to be a copy of his that was wrong! and for this excellent reason too, that "both pipes being in section, they were both open"! This was repeated by these judges of the fact, and be it remembered, was allowed to pass uncorrected, as if the court itself was stultified by the amazing stupidity of the jury. If this decision was a strange one, two of the others were "passing strange," for the absolute impossibility of their being copies, was clearly demonstrated to every body, but the bewildered senses of those who were appointed the judges; they, indeed, plainly saw, that drawings could be "TRACED through this paper against the glass", of double the size of the originals, or with the component parts in different positions, and of different figures, and of different proportions! Verily, much remains yet to be discovered in the laws of optics!

Had it been possible to obtain a jury of draftsmen or engineers, we should have been happy in trusting our case into their hands, by having a new trial, but as the law afforded us no security, against a second jury equally incompetent to the first, we waived our right to have the question of *fact* tried again, and contented ourselves with an endeavour to set the unjust verdict aside, on the ground, that our opponent had not conformed to certain conditions of the act of parliament, by which his assumed monopoly was protected. These points of law have now been argued before the four judges of the Court of Common Pleas, and after a few weeks' private consideration by their lordships, their decision was recently pronounced by Mr. Chief Justice Best; by virtue of which, the verdict of the jury is set aside, as regarded two of the subjects, and confirmed against us as regards the other two. These two subjects are, Wright's Bleaching Machinery, and Murray's Locomotive Carriage, which nobody in their senses, could for a moment believe it possible we had copied; unless, indeed, they possessed (like our unfortunate jury) that peculiar obliquity of vision, which occasions objects to appear in the reverse position to that in which they really stand.

The legal point, by which we endeavoured to overset the verdict as regarded the two last-mentioned subjects, is both an interesting, and an important one; we trust, therefore, that a short notice of it, will not prove unacceptable.

Our readers well know, that it is the universal practice in copper-plate engravings, for the artists to put their names at the corners of the plates; this they do to get business, or for fame. For one or both these motives, the practice has existed for nearly two hundred years; yet previous to the 17th of George the 3d, there was no copyright in engravings; and when the act was passed conferring the grant, it was upon the condition, that the proprietor or proprietors of the plate, should put their true names and date at the bottom. The objects of the legislature in making this condition, are too obvious to need mentioning; and it is perfectly clear, that they intended the public should know who the proprietors were. Now on the copper-plates in question, Newton's name appeared only as the draftsman, the words being simply, *W. Newton del.\** and at the other corner of the plate was *G. Gladwin sculpit.* Now Gladwin was not a proprietor, and who could suppose that he was, any more than Newton; neither of them having claimed for themselves, any more than being the artists. Yet the judges have determined, that Newton has conformed to the conditions of the act! What does common sense say to this?

## London Mechanics' Institution.

THE delivery of Mr. STONE's third Lecture on the Stability of Floating Bodies has been deferred till the 13th Instant, in consequence of the Quarterly General Meeting of the Members, which took place last Wednesday, the 6th of June, which meeting we shall notice in our next number. DR. BIRKBECK's Lectures on the Structure of the Human Body continue to occupy the Friday evenings.

## PATENT LAWS.

A MEETING on the 5th Instant was held at the Theatre of the London Mechanics' Institution, which the parties who called the Meeting had hired for the purpose, in order to take into consideration the present state of the Patent Laws. Dr. Birkbeck, who was accidentally present, moved that Major Shaw should take the Chair, and Mr. Fernandez, the gentleman who had been most active in getting up the Meeting, was appointed Secretary. This latter gentleman explained that the object was, to petition Parliament for the alteration of the Patent Laws.

Dr. Birkbeck moved the first Resolution by solicitation. The object of the Meeting was a proper one—it was to take into consideration the influence of the regulations under which patents were at present granted. The resolution referred to a petition for some change in the regulations for granting letters patent, which did not presume to suggest any legislative experiment. The difficulties in the way of obtaining patents were known, and the oppressive nature of the law was felt. Many, who best deserved the advantages conferred by a patent, were incapable of obtaining them. They had not the means themselves, and were afraid of disclosing their inventions, lest they should be appropriated by others. Tens, he believed hundreds of cases, came to his knowledge of this description. This was quite sufficient to make the Meeting support the resolution he should then propose, which was, "That the present regulations for granting Letters Patent for Mechanical Inventions and Chemical Discoveries are ineffectual and oppressive," which was seconded and carried unanimously.

Mr. Toplis moved the second resolution, which, as subsequently amended, was, that a petition be presented to both Houses of Parliament, praying that some inquiry should be made into the mode of granting Letters patent for inventions and discoveries.

Mr. Rotch seconded the resolution, but begged it might be distinctly understood, he had nothing whatever to do with calling the present Meeting. A great good, he was satisfied, would result from an alteration of the Patent Laws. From the very high point which our country had reached in mechanical skill, any man who now invented any thing calculated to improve the arts, must have an extraordinary share of talents and ingenuity. As he had been alluded to

\* It is worthy of remark, that Newton's name appeared in the same manner, when Messrs. Sherwood, Nooly, and Jones, were proprietors of the work; consequently upon no principles of logic, could that be considered evidence of his being the proprietor.

by his friend, Dr. Blacklock, he found himself compelled to say a few words on the mode of granting letters patent, by which persons who made any discovery or invention were secured its advantages. The person making such a discovery, petitioned the Crown to have such letters patent, and the Crown referred the petition to the Attorney or Solicitor-General, with orders to make out the patent in such terms as he thought proper. The restrictions applied to a patent on granting it, were not the result of any Act of Parliament, for there was only one Act of Parliament on the subject, but they were restrictions imposed at the discretion of the Attorney or Solicitor-General. They did, in fact, regulate their conduct by the conduct of those who had preceded them in office, and they could not do otherwise; but they had a discretionary power. In a particular case, the attention of the Attorney or Solicitor-General might be called to the subject, and he had the power to redress any injuries.

The first thing to be done was, to inquire; and the object of the Meeting, as he understood it, was merely to present petitions to Parliament, with a view to have an inquiry instituted; and he would, therefore, take the liberty of throwing out a hint or two as to the source of the great difficulties now met with in obtaining patents. One of the greatest defects of the present mode was, that in all patents a clause was inserted obliging the patentee to lodge a written specification of his invention in Chancery, within a certain time from granting the patent. To describe machines in writing, or by drawings, was a very difficult task, and many of those persons most interested in obtaining patents were unable to draw up written specifications. To obviate this difficulty, he would throw out a suggestion to the Meeting. It was not sufficient that the mechanic did his best in drawing up the specification, or in making the drawings; but he must have it done by a lawyer; he was obliged to apply to an attorney to get a counsel to draw up the instrument for him; it was to be done in a legal manner, and only lawyers were competent to do it. But many lawyers were not mechanics; and, after the mechanic had done his best to instruct the lawyer, he at last found—and this was a very great hardship—that he could not enjoy the fruits of his ingenuity, because some little mistake had been made in drawing up the specification; some little word had been left out; and the ingenious inventor lost all the benefit of his invention, because his lawyer had been wrong. Patent property was, consequently, never very secure, and this was the reason why men who possessed capital were in general very unwilling to come forward with money, and assist ingenious men. It was not of much use, however, to point out the source of the evil, unless a remedy was also suggested; and he meant to throw out one for the consideration of the Meeting. Instead of calling, as at present, for a specification in writing, and an explanation of the machine by drawings, he would call on every inventor for a working model of his invention, and he would have this deposited in some public place. The inventor could make the model, and the blame would be thrown on his shoulders if he did not make it properly, and sufficient to show his invention. This would take him out of the hands of the lawyers, and save him all that expense which he was now put to for the purpose of getting the drawings made, and specifications drawn up. He would have, also, some public place appointed for the reception of these models, and then we should have the most splendid collection of such things ever made. To it every inventor might go, and might be spared a great deal of trouble by seeing what had been already done. At present it very frequently happened that the same thing was invented at two or three places, and by two or three persons. Nor was this, as some of his friends had sometimes observed to him, at all remarkable. Some particular thing was wanted, some movement to make a machine perfect, some wheel to adapt it to some other object, and all knew very well what particular thing it was that was required. They all were striving, therefore, to attain the same object, and it was not at all wonderful that two or more inventors should find out the same means of accomplishing it. Dishonest men would learn from such an exhibition how vain must be their attempts to appropriate the inventions of others, and honest men would learn from it to save themselves much unnecessary labour, by seeing what others had done. The public would also reap as much benefit from substituting models for specifications as the patentees themselves.

Another great evil of our present patent regulations—an evil which was not experienced in any other country—arose from the delays of office. After the patentee has paid his money, he must wait three months for his patent, to go through the forms of office. During that time the public were informed that he had applied for a patent, in a particular branch of art; the ingenuity of other persons was immediately directed to the same object; and if, during these three months, any similar discovery or invention was made, the person who had been at all the expense of a patent with it, had lost it by the delays of office. This was a great evil, and how was it to be remedied? He would suggest a plan similar to that which had been adopted in other countries. In some of them the delays of office were as great as they were here; but in all of them, when any person claimed a patent, he received a receipt or certificate, which, from that moment, secured him the undisturbed possession of his own improvements. The only object contemplated by the Meeting—that of petitioning Parliament to take the state of the Patent Laws into consideration—was, he thought, most desirable, and the two points he had already stated, were sufficient, he thought, to make them adopt the resolution he had seconded. The object was of great importance, involving the whole mechanical ingenuity of the empire. They were not considering this or that patent, but whether all the ingenuity of the country should be protected. It was of great importance to the general march of improvement, and to the progress of intellect; it was of great importance also, on account of the extensive education which the people now received, much of which was communicated within those walls, and which was every day developing the mechanical ingenuity and intellect of the country.

Mr. Roitch suggested an amendment in the resolution, which was, as amended, unanimously carried.

Baron de Berenger addressed a few words to the Meeting, approving of its object, and generally of the observations of Mr. Roitch; but he disapproved of having a collection of models open to the public, as that would enable foreigners to rival us in ingenuity.

A petition was then read and agreed to.

Some conversation took place as to what gentleman should be entrusted with the petition, and it was at length agreed to appoint a Committee to consider the question, and wait on whom they should select, requesting him to present the petition, and support it in Parliament. Thanks were voted to the Chairman, the Secretary, and, generally, to all those who had contributed to get up the Meeting, and the assembly dispersed.

**History of the Steam Engine, Chap. VI.***Continued from p. 480.*

In 1821 a patent was obtained by Mr. Job Rider, of Belfast, in Ireland, for a rotative engine which has been the subject of great encomium in several periodicals of the day, some of which have not hesitated to declare, that in it was to be found the solution of the grand problem hitherto sought after in vain. But although we have been favoured with some very diffuse remarks by these works, all of them have omitted to notice the fact of its being nearly a fac-simile of a machine patented by Messrs. Bramah and Dickenson thirty-one years previous to this date. We do not mean to declare that Mr. Rider is not the inventor of this machine, because although a minute description and engraving of it is given in one of the early volumes of the *Repertory of the Arts*, yet we well know that this work is too scarce to be found in the hands of every inventive mechanic: besides which, it is highly improbable that Mr. Rider would have incurred the expense of a patent or patents for a machine which was notoriously the subject of a previous one. It is, however, to be regretted that Mr. R. was not better informed on the subject, because the two plans resemble each other so closely, that one might almost fancy they had been drawn from the same model. We refer our readers, for a full explanation of the principle, to page 66 of this work, and have merely to add, that a respectable manufactory in Scotland expended a very considerable sum in constructing and applying one of these engines during the year 1825, but have abandoned it from the impossibility of keeping it even tolerably steam-tight.

Mr. Thomas Masterman's rotatory engine, patented 1821, comes next under our notice.

Fig. 1 represents a vertical and central section of the troke (being that part of the engine which revolves). Fig. 2 is a transverse section of it, and of the two masks after mentioned. The troke is composed of the axis, of the nucleus (being the central parts, and through which the axis passes), of the annulus (being a hollow ring, in which are placed valves), and of the radii (being the steam passages between the nucleus and the annulus). The surface of the face is a perfect plane. The axis passes through the hole (1) at right angles with the plane of the face. Six holes (2) of similar figure and dimensions with each other, are sunk in the face, at equal distances, in a direction parallel to the axis, for three or four inches; then curving into a direction at right angles with the axis, they open in the periphery of the nucleus.

The annulus (A) consists of six equal segments. At each of their joints is fixed a valve, which, by being ground on its seat, is rendered steam-tight when closed.

The radii (1, 2, 3, 4, 5, 6) are connected with the nucleus and annulus, so as to form steam-tight communications between each hole in the face and the inside of the annulus. Fig. 3 is a plan of the inner mask; being a circular plate of metal, of equal diameter with

Fig. 3.



the face, about two inches thick, and having each side perfect planes parallel to each other.

There are four holes (1, 2, 3, 4) through it: 1 is of sufficient size to admit the axis; 2, 3, 4, are each one-sixth of the space that would be included by completing the two concentric circles, segments of which form the sides of those holes; and those circles are described with the same radii as the segments of those which bound the holes in the face. Thus, each of these holes would extend over one of the holes in the face, and one of the adjoining spaces: the space between 2 and 3 is of such dimensions as just to cover completely one of the holes in the face. 4 is situated so as to leave equal spaces between it and 2 and 3.

The periphery of this mask is clasped by an iron hoop, from which projects a lever, extending nearly to the annulus, and having a small inclined bar placed across its end. The two projections from fig. 4 represent the beginning of the lever.

The outer mask is a circular piece of metal of the same diameter, and about the same thickness as the inner mask.

The axis passes through both masks; the inner mask is placed next the face, the other next the inner mask, and both are kept closely pressed towards the face (by means of screws acting on the back of the outer mask) so as to be steam-tight with each other and with the face: a trifling pressure suffices to make them so, the opposed surfaces having been ground on each other. The outer mask is placed in such a position with respect to fig. 1, as that the pipe 2 may be horizontal, and point towards radius, fig. 2, and it always remains stationary. The inner mask is placed in such a position with respect to the outer mask, as that the holes 2, 3, 4, in the former may communicate with pipes corresponding in the latter, and thus form a communication between the pipes communicating with the boiler and the air. Thus the holes in the inner mask are for the same relative purpose as the pipes in the outer mask.

The transverse sections of both masks, placed in their relative positions, are represented in fig. 2.

The corresponding letters in fig. 1 and 2 refer to the corresponding parts in figure: *pp* is the axis, *gg* are its bearings.

As the valves, and the gear for regulating them, are precisely the same in each segment of the annulus, only two of them (one showing their position closed, the other open) are lettered for reference.

Each valve (*f*) is similar to the other, and opens in the same direction; its gudgeons, moving freely in sockets, fixed to the sides of the annulus nearest the axis.

Their working-gear is as follows: *a* is a small hollow protuberance or bonnet screwed on the annular, and communicating with the inside of it; on one of its inner sides is a socket, on the opposite a stuffing-box; one end of a spindle works in the socket, the other passes through the stuffing-box to the outside of the bonnet; to this end is attached the lever *b*, and to the centre is attached the lever *c*; both levers being at right angles with the spindle, and in the

opposite direction to each other. To the extremity of *c* is attached (by a moveable joint) the rod *d*, and to the extremity *b* is fixed the weight *e*, being more than sufficient to counterpoise *f*, which is connected with it by means of a moveable joint at the other end of *d*, and attached to the centre of *f*. The levers are so placed as to cause *f* to be half open when they point to the axis. Thus it is evident that, during the revolutions of the troche, two of the valves (*f*) on its ascending side (denoted by the arrow) will, by the mere preponderance of *e*, be shut, and the whole of the others will be open, as represented in fig. 1.

For more easily comprehending the action of these valves, let it be considered that their movements are regulated by the mere gravity of *e*.

The machinery to which motion is to be imparted is attached to that end of the axis next fig. 1.

The steam is generated and condensed in the usual manner.

The principle on which the engine acts, is by a liquid body (water or mercury for instance) placed in the annulus, being pressed on one side of the troche by the steam, until that side gains such a preponderance over the other as to overcome the resistance of the machinery attached to the axis, and by being then sustained there, so as to maintain the preponderance during the revolution of the troche.

The engine represented by the engraving is one in which water is the liquid made use of in the annulus. The manner in which it is worked is as follows:—

The annulus is nearly half filled with water, which need never be withdrawn. The troche is placed so as to have two of its radii in a vertical position. The steam-cock is turned; consequently the steam rushes through the pipe and hole (2) in the outer and inner masks, and through the lowest hole in the face into the lowest radius; and, after imparting to the surface of the water in that radius its own temperature, it presses such water downwards, and flows into the annulus, condensing in the water therein, until it has imparted to it, also, its own temperature, which will be rapidly accomplished. On the temperatures becoming alike, the steam will rise through the water on both sides of the troche, and, meeting with a closed valve on one side, will press the water which is beneath it downwards, and consequently cause the water on the other side to rise proportionably, until the preponderance thus given to that side be sufficient to overcome the resistance of the machinery attached to the axis, immediately whereupon the troche will begin to revolve. The load, or resistance of the machinery, remaining the same, and the supply of steam being equable, the water will remain nearly stationary during the revolutions of the troche: its surfaces are denoted by the lines at *n* and *o*.

As the troche revolves, each of the holes in the face communicates in succession with 2 in the inner mask.

It should be borne in mind, that, as has before been observed, the position of the inner mask is never so far changed as to prevent

2 and 3 therein communicating with the corresponding pipes in the outer mask, when the engine is at work.

By the construction, one entire hole in the face, or parts of two, equal to one, is, or are always in communication with 2 in the inner and outer masks; so that there is always an equable flow of steam into the annulus, preventing the depressed surface of the water rising with the ascending closed valve.

The holes in the face, as they pass in succession from 2 to 3 in the inner mask, are entirely closed by the space between them; and immediately on communicating with 3, the steam confined between the two closed valves rushes from the annulus, through 3, into the air, or into the condenser, if one be used. And until the same hole in the face has passed 3, a communication with the air, or the condenser, remains for the discharge of the steam.

The pressure of the steam being thus removed from each valve, (f) as it arrives at this point, it will, by the gravity of *e*, open as it begins to descend, (see the valve partly open in fig. 1) and thus allow the column of water to remain on that side of the stroke.

The water will fill the radii as their ends descend beneath the elevated surface, *o*, and will remain there until the steam presses it out at about *a*, but cannot escape, if before it enters them the hole in the face has pressed the hole 3; otherwise, however, the water would escape through that hole into the air, or condenser.

A uniform rotatory motion is thus produced and maintained as long as the steam flows equably into the annulus, acting with a force proportionable to the preponderance of the water on one side of the stroke over the other. This force is easily estimated, being equal to the weight of a perpendicular column of water, having the difference of the two levels for its altitude, and the area of a transverse section of the annulus for its base, pressing against the closed valve.

The difficulties which are stated to have been obviated or lessened by the invention of this engine are, "1st, The skill and nicety of workmanship required in construction and erection; 2nd, The cost of construction and erection; 3rd, The space they occupy; 4th, The expense of working and keeping them in repair; 5th, The power lost by friction, by alternate movement, and by the oblique direction in which the power is exerted through the medium of the crank rod; 6th, The great pressure of steam required to work with any economy without a condenser; and 7th, The trouble of putting them in motion when they stop with the crank in a vertical direction, and the care required to prevent the fly-wheel taking a reversed motion."

Before going into Mr. Masterman's remarks as to how far these faults are obviated, it may be worth while, in the first place, to see whether all of them exist. On this it may be said, that the first, second, third, and fourth, are evils which have justly occupied the consideration of nearly all mechanics since the general adoption of the steam-engine, and are in reality evils of such a nature as to be evident to every one.

[Our author next proceeds to examine into the fifth, sixth, and seventh assumed disadvantages of reciprocating engines, and to dis-

cuss the merits of Mr. Masterman's mode of obviating them, for which we must refer the reader to Mr. Galloway's separate Work, pp. 180-1.]

We shall now shew what appears to have been the cause of failure. This seems chiefly to have been the great condensation, arising from the exposure of the steam in the annulus. The steam occupying one half of the circle becomes dispersed, as it were, in a long bended pipe, which is subjected to the disadvantage of passing through the air by which the condensation must be increased.— Another cause of condensation is the difference in temperature, between the depressed and the elevated surfaces of the water." The lower surface being continually in contact with the steam, is nearly of the same heat, whilst the upper surface is considerably colder. Now the different segments of the troke, successively lose a portion of their caloric, as they *pass over* the cooler portion of the liquid; and in this cooled state become the recipients of the steam; and although there is a tendency in the machine to bring all parts of the water to an equal temperature, it was found preferable to prevent such a consequence, by a supply of cold water, as the elevated surface when so heated expanded into steam, and escaped through the discharging pipe.

Another and secondary cause of waste takes place, when there is the least variation in the resistance of the load; when that is uniform, the steam exerts merely the force necessary to overcome it; but upon the resistance being increased, the steam then forcing upon the yielding surface of the water, without immediately producing the required speed, drives a considerable quantity of it over the upper part of the annulus, into the empty side of the wheel; and by occupying its place, rises by its inferior gravity upwards through the water, and escapes through the discharging pipe without producing any effect. When this takes place, it is some time before the water returns to its proper situation, or becomes a sufficiently steady abutment to produce the required powers.

The consequence of these defects were extremely apparent in the engine alluded to; the waste of caloric being such that few persons could endure the heat of the engine-house when the engine was working. The waste by condensation was so great, that it required a boiler of sufficient capacity to have worked a reciprocating engine of 36 horses power, merely to drive a small circular saw, which could have been easily driven by an engine of 2 or 3 horses power. The varied resistance produced by sawing wood, rendered the last-named defect very apparent; and, indeed, considering the degree in which its effect was weakened by the *irregularity* of its load, perhaps a saw was the most ill-judged application of its force.

We have been thus particular in our investigation of this ingenious machine, because several scientific friends were disappointed by its failure, and because both Partington and Stuart have anticipated, that "if ever rotatory engines should be brought into successful competition with the common steam engine, it appeared probable that they might be constructed on this principle." We

perfectly agree with the latter writer, however, in this opinion, that much credit is due to Mr. Masterman for his very clear and interesting account of his machine, and the candid appeal which he makes to experiment. We trust in examining the pages of his little pamphlet that we have been divested of every prejudice, and that our apparently severe examination will be attributed to the proper motive. It is sincerely to be wished that more would follow his example, and fairly submit their inventions to the public, divested, like his, of all mystery and quackery; the advantages which would arise from this liberal proceeding would be incalculable.

*(To be continued.)*

### LIST OF NEW PATENTS SEALED, 1827.

**CARDING AND SPINNING.**—To James Whitaker, of Wardle, near Rochdale, for improvements in carding and spinning machinery. April 24. Two months.

**WEAVING.**—To Carlo Chigo, late of Lyons, but now of Fenchurch-Street, London, for improvements in weaving machines. April 24. Six months.

**SUGAR REFINING.**—To Morton William Laurence, of Leman-Street, Goodman's Fields, for improvements in the process of refining sugar. April 28. Six months.

**ALARM WATCH.**—To Joseph A. Berrolas, of Great Waterloo-Street, Lambeth, for a detached alarm watch. April 28. Two months.

**CHAIRS AND SOFAS.**—To Robert Dawes, of Margaret Street, Cavendish-Square, for improvements on chairs, &c. to increase ease or comfort. April 28. Six months.

**BEDSTEADS.**—To Thomas Breidenbach, of Birmingham, for improvements in bedsteads. April 28. Six months.

**SMEETING FURNACES.**—To Doctor Benjamin Somers, of Langford, Somersetshire, for improvements on furnaces for smelting different kinds of metals, ores, &c. April 28. Six months.

**BRUSHES.**—To William Lockyer, of Bath, for improvements in the manufacture of brushes. April 28. Six months.

**TELL-TALE MACHINE.**—To Henry Knight, of Birmingham, for a machine to ascertain the attendance on duty of any watchman, workman, &c. and for other purposes. April 28. Six months.

**RECTIFICATION OF SPIRITS.**—To John McCurdy, Esq. of Cecil Street, Strand, for improvements in the process of the rectification of spirits. April 28. Six months.

**NEW COMPOSITION FOR BRICKS, &c.**—To J. Browne, and W. D. Champion, of Bridgewater, for a composition for making into bricks, or for moulding into architectural ornaments, &c. May 5. Two months.

**CARRIAGE WHEELS.**—To David Bentley, of Eccles, Lancashire, for an improved carriage wheel. May 8. Six months.

**DIBBLING MACHINE.**—To T. P. Coggin, of Wadworth, Yorkshire, for a machine for the dibbling grain of every description. May 19. Two months.

### TO OUR READERS AND CORRESPONDENTS.

We thank Mr. GOMPERTZ for his valuable communication, which shall certainly appear in our next; Mr. G. must, however, excuse our not adopting the drawings sent for elucidation, as they do not exhibit the construction so clearly as PERSPECTIVE drawings of the subject which we are now making. The model is ready at our Publisher's to be returned.

Mr. SCHALLER's Patent Expanding Clogs, we hope to get in our next Number.

*The next number will complete our Fourth Volume, and the First Series; it will therefore contain the Index, Title-Page, Preface, &c.; and a Prospectus of the Second, and we trust, much improved Series.*

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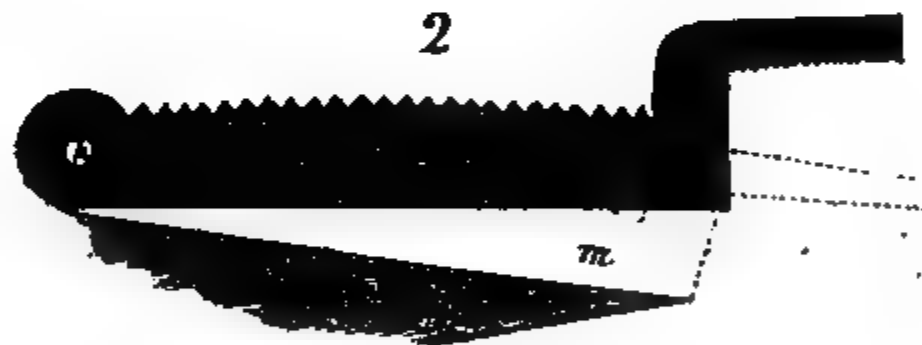
# REGISTER

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**GOMPERTZ'S  
EXPANDING CHUCK FOR TURNING LATHES.**

VOL. IV.

K K

## MR. LEWIS GOMPERTZ'S EXPANDING CHUCK, FOR TURNING LATHES.

THE want of a chuck or appendage to a lathe, which shall enable the workman to fix, concentrically, firmly, and speedily, the materials he has to turn, has long been experienced by all persons engaged in turning; and has given rise to various ingenious inventions for the purpose. Among these are to be noticed *chucks with three screws*, between which the substances are held; and particularly the *universal chuck*, where, by means of a right and a left handed screw, cut on the same rod, and which goes across the chuck, two cheeks are caused to slide to and fro always in the centre, whereby the materials are held also. The former, however, has two objections; firstly, the difficulty of adjustment, and secondly, the projection of the screws into the way of the workman. The universal chuck serves either as a hollow chuck, or as a mandrill: but only having two cheeks instead of three, it does not hold so firmly as the former; and besides this, is rather an expensive apparatus. The consequence of these objections is, that though both are useful tools, turners generally employ common chucks, with round holes, the exact size of the piece to be turned, while, by the difficulty of providing such chucks for all sizes, much loss of labour, and vexatious disappointment, is the continual result. The method we have to offer is shewn by the figures on the other side of this page.

Figures 1 and 3 represent two perspective views of the chuck; the first, as employed to grasp a piece of wood or other substance of large dimensions;—the second is an opposite view, with the jaws collapsed to bite a smaller object. Fig. 2 shows one of the jaws or clamps separately. The same letters in each figure refer to the same parts.

The body of the chuck *a* is cylindrical, and made of hard wood, with a screw thread cut upon its periphery; three longitudinal rectangular grooves, *b b*, (only two of them are seen) are then made throughout its length, slantingly, as shown by the dotted lines *c c* in fig. 3. The three clamps, *d e f*, (one of which is shown entire by fig. 2,) are then fixed in these grooves by their jointed ends *g*, by means of pins through their centres *h*, which pass through the solid back of the chuck *i*, and are rivetted to the metallic hoop of the same *k*. The clamps thus fixed, have a range of motion in the grooves as represented more clearly by fig. 2; the shaded part, *l*, shows the clamp in the position when employed as seen in fig. 1; the same in dotted lines, *m*, when employed as seen in fig. 3; and the angular piece, *n*, represents that portion of a triangular pyramid which is formed in the centre of the cylinder, *a*, by the slanting cuts before mentioned.

The clamps, *d e f*, are made strong, steeled and hardened at the jaws, their external edges (curved as represented) are filed into grooves or notches, to correspond with the screw thread on the hard wood cylinder *a*; the metallic ring, or circular nut, *o*, which is of course cut with a screw to fit both the former, can therefore be wound

over any part of the cylinder, and by that means hold down the clamps firmly to the object which they grasp. When the ring is situated as in fig. 1, the jaws are open to receive a large piece; and when moved round towards the back, the ring operates to press down the clamps, owing to the curvature of their serrated backs. The projection *p*, on the ring *o*, is for the convenience of applying any thing to it to move it round forcibly, and a hole is made through it for the insertion of a wire. The jaws of the clamps should be notched like those of a vice, to obtain a secure hold of the objects placed between them: *r* is the screw by which the chuck is fixed to the lathe.

The body of the chuck may be of hard wood, as cocoa, lignum vitæ, box, yew, or holly: the jaws may be *straight*, or may be *el-bowed* as they are represented in the figures, by which means they hold a larger piece. The jaws may also have *caps* to go on occasionally, so as to reduce the capacity. And if their circular motion should be found objectionable, they might perhaps be made to work parallel, by having a *pin*, to work into a corresponding *hole* or *tube* in the back ring, or other part of the chuck, instead of working upon a *centre* at *h*, the outside of the lever being properly shaped, to suit the degree of sliding motion required. There are also other varieties that might be adopted, such as fixing the lever upon a centre in the *middle* or *front* end, instead of the back end; by which means the levers would open and shut differently or reversedly to what they now do; but when the levers are attached near to the front end, they should go above the ring instead of underneath: and perhaps for some purposes, the *screw* upon the cylinder and in the ring, and the teeth in the levers, might be omitted.

From these chucks, having *bars* or levers, which work truly to the centre or axis of the lathe, the inventor calls them *centre bar chucks*.

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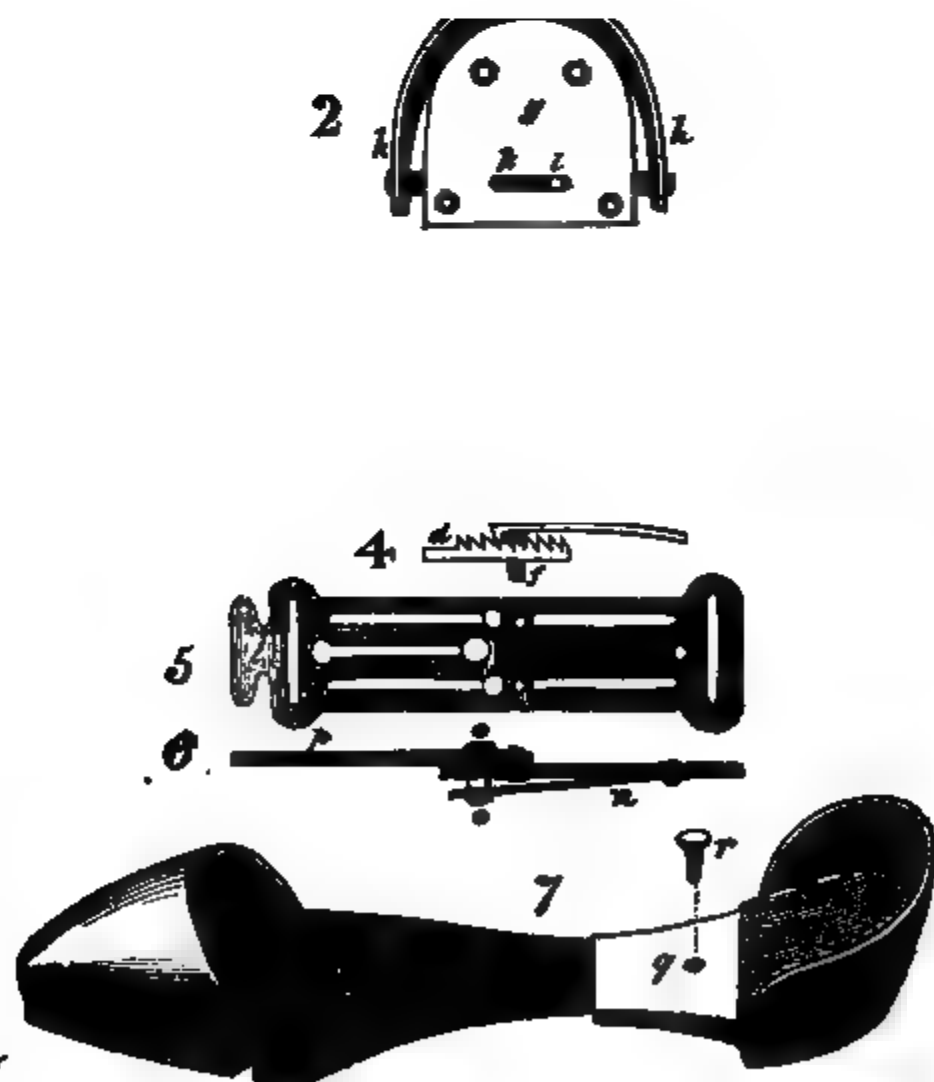
### SCHALLER'S PATENT EXPANDING CLOGS AND PATTENS.

It matters not the size of the feet, be they even of the growth of Lilliput, or Brobdignag, or the substitutes for feet upon which the ladies of the Celestial Empire hobble about, Mr. Schaller, of Regent Street, can, with a single pair of clogs, or a single pair of pattens, fit them *all*. The above drawings, however, are not intended to represent so splendid an example of the patentee's ingenuity; in these, the degrees of expansibility, and of contractibility, are rendered suitable to the loco-motives of an ordinary family: and as it requires neither eloquence nor argument to convince all the world that the convenience and advantage of such an invention must be immense, we shall spare ourselves the trouble of attempting to exercise either, and proceed at once to the explanation of the drawings.

Fig. 1 represents a man's clog in perspective, with the contrivances for expanding or contracting the same, agreeably to that mode

which the patentee finds to answer best in practice; under the brass ferrule at *a* is a sliding rack and spring, or other contrivance, by which the clog can be lengthened or shortened at pleasure; at *b* is another rack and spring, which allows the raised sides of the heel-piece to be expanded or contracted breadthwise. To the strap *c* is likewise attached an improved spring slide, by which that also may be lengthened or shortened. These several contrivances are exhibited in detail, in figs. 2, 3, 4, 5, 6, which need but little explanation to comprehend them.

Fig. 3 represents a plan of the upper side of the sole of the clog, without the brass ferrule or sheath *a*, (and with another flat plate, which incloses the work underneath) removed; the rack *d*, and the



spring *e*, are thus brought into view, the former being screwed to the waist of the sole, and the latter to the heel-piece, in cavities or mortices made to receive them, and so that they shall act free from obstruction. They are likewise so fixed that the spring always keeps in contact with the rack, as shown by the edge view of them in fig. 4, wherein it is seen that there is a stout pin *f*, which goes through a slot mortice in the rack; this pin slides backwards and forwards in the slot mortice.

By this arrangement it will be seen that the clog may be contracted by simply thrusting the toe part towards the heel, as the spring catch which is fastened to the former slides over the notches in the rack; but to pull the toe from the heel, in order to lengthen the clog, it becomes necessary to press upon the extremity of the brass pin *f*, which in the clog protrudes a little way through the brass sheath *a*, either on the upper or the under side.

Fig. 2 represents a plan of the *upper side* of the superadded heel piece, which consists of a metal plate *g*; the sides, *h h*, are here shown as expanded for the reception of a large foot; to contract it to suit a smaller foot, it is only to press the sides *h h* together, when a spring catch (nearly similar to that already described in the other part of the clog) slides over the notches of a rack, and fixes itself wherever it is left. On the contrary—when it is wished to increase the capacity of the heel, the guide pin *i*, which slides in the slot mortice *k*, is to be pressed upon by the thumb nail, which thrusts the spring catch out of contact with the rack, and the sides, *h h*, spring out again in the position shown in the figure, owing to their having a metallic lining, (of thin plate iron) which possesses sufficient elasticity for that purpose; the four screw holes shown in the heel plate *g* are for the purpose of fastening it down to the wood or leather heel-piece of the clog.

The slide for lengthening or shortening the tie of the clog across the instep of the wearer, is shewn on an enlarged scale at figs. 5 and 6, the same letters in each referring to the same parts. It consists of two plates *l l*, laid flatwise, in contact with each other, with four long apertures or slots, in each of which slides a brass pin: two of these pins are rivetted to each plate, and confine the opposite plate in contact, by their heads projecting over it. To give an increased friction to the sliding plates, and to stop their action, a spring *n* is fixed to one of the plates, with a brass catch pin *o* at the other end; so that when the slide is shut up, as shewn in fig. 1, the pin *o* enters the hole *p*, where it is retained, until pressed out again in order to lengthen the tie as may be required.

By fig. 1 we have exhibited a clog, closed up or contracted to its least extent; by fig. 3 the same is shewn partly drawn out; and by fig. 7, another kind of expanding clog, in which it is elongated to its greatest extent.

This last mentioned fig. 7, is a clog more especially adapted to ladies' wear, in which another mode of lengthening or shortening the clog is adopted. In this instance, a thin iron bar or plate is perforated with holes, and rivetted to the fore part of the

sole, and kept steady by two pins on either side; the other end of the perforated plate enters the heel of the clog, and is so formed at the extremity, as to prevent it being entirely drawn out. Now the brass sheath *a* has a hole at *q* as shewn, and another directly opposite to it at the bottom: the pin *r* being then passed through both holes in the brass sheath, and through any one of the holes in the intervening perforated plate, fixes the clog firmly in the place required.

The patentee has proposed and employed, several other modes of contracting and expanding clogs, which are exhibited in his specifications, (the original drawings for which we made,\*) but as he informs us, that he has found none answer so well in practice, as the rack with the spring catch, we have chiefly confined our account, at his suggestion, to that particular method of accomplishing them.

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### MACKINTOSH'S PATENT PROCESS OF PREPARING STEEL.

In the ordinary mode of preparing steel, carbon in substance, (charcoal,) is used to impregnate the iron, and it has hence been commonly considered, that the carbon combined *mechanically* with the iron, to form the new substance, steel: our chemists have, however, long been of opinion, that it is a *chemical* combination that takes place, by the gradual absorption of carbon, in the gaseous state, by the iron. We know that this view of the matter was entertained by the learned president of the London Mechanics' Institution, and was mentioned by him in one of his public lectures. The fact has however been proved by Mr. Charles Mackintosh, of Crossbasket, Lanark; who has taken out a patent for preparing steel, by subjecting the iron to a stream of carburetted hydrogen gas, evolved from coal under distillation.

The iron is enclosed in a pot or crucible in the furnace, and when arrived at the proper heat, a stream of gas is directed by a pipe into the crucible, which has another aperture to allow that part of the gas to escape, which has not been taken up by the metal. The apparatus for conducting this process, will of course admit of various modifications: the steel formed by it is said to be of excellent quality.

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### London Mechanics' Institution.

A QUARTERLY general Meeting of the Members of this Institution was held on Wednesday, the 6th of June instant, to receive the Committee of Managers' Report of their Proceedings during the quarter; from which it appears that all the departments of this interesting Society are going on well. The financial affairs are improving: the classes have been increased since the last Report of the

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\* For his agent, Mr. Wyatt, the talented Editor of the Repertory.

Committee; the library has been augmented, and a regulation has been adopted for allowing certain privileges to such Members as make presents to the Institution of books, services, &c. The whole of the Lectures which have been delivered during the past quarter have been noticed in the Register already; and arrangements have been made for Professor Millington and E. W. Brayley, Esq. to deliver Lectures after the conclusion of the Courses now in progress; viz. on the Structure and Functions of the Human Body, by Dr. BIRKBECK, and on the Stability of Floating Bodies, by W. STONE, Esq. The business of the Meeting, which was conducted throughout with much propriety, was concluded by passing votes of thanks to the gentlemen who had delivered Lectures, or rendered other services to the Institution during the quarter; and finally, to Dr. Birkbeck, the president, for his valuable and instructive Anatomical Lectures, and for his able and impartial conduct in the chair.

On the 8th instant, at Dr. Birkbeck's Seventh Lecture, which was principally devoted to Muscular Action, Mr. Lutz, one of the conductors of the Gymnastic Exercises at the London Gymnasium, was introduced to the members, and exhibited several remarkable feats of muscular strength. We observed a striking resemblance between Mr. Lutz's pectoral muscles and muscles of the arm, which were shown to the members, and those represented in a seven feet figure of Chabrias, exhibiting the attitude in which he withstood the attack of Agesilaus, the victorious Lacedæmonian general, which with a great variety of other statues was introduced for the illustration of the Lecture.

The Doctor's Eighth Lecture was delivered on the 22nd, and his Ninth, which will terminate the first division of his Course, will be delivered on the 29th.

MR. STONE's Third and Fourth Lectures were delivered on the 13th and 20th; and MR. BRAYLEY will commence his Course on Lumeniferous Animals, &c. on the 27th of this month.

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### **History of the Steam Engine, Chap. VI.**

*Continued from p. 496.*

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With the intention of completing this History of the Steam Engine within the present volume, we have already extended it to 128 pages more than the previous volumes: this has enabled us to insert all the engines described by Mr. Galloway up to the year 1820. The remainder of the engines introduced by Mr. Galloway into his separate Work have for the most part already appeared in the Register of Arts and Sciences; they are as follow:—

|                                         |                              |
|-----------------------------------------|------------------------------|
| Perkins's Engine, . . . . .             | described in vol. 1, p. 369. |
| Brunel's Engine, . . . . .              | — 4, p. 327.                 |
| Alban's Engine and Generator, . . . . . | — 3, p. 114.                 |
| Brown's Gas Engine, . . . . .           | — 1, p. 337.                 |
| Brunel's Gas Engine, . . . . .          | — 3, p. 258.                 |

**Metallic Pistons**, . . . . . vol. 3, pp. 169-70. 184.

**Foreman's Rotatory Engine**, . . . . . vol. 3, p. 217.

**Eve's Rotatory Engine**, . . . . . vol. 4, p. 17, 33.

**Beningfield and Beale's Engine**,—**Marquis de Combis' Engine**,  
—**Elijah Galloway's (the author's) Engine**. These being very recent  
inventions, and the last not yet enrolled, will appear in the early  
numbers of the forthcoming New Series of this Work.

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### PEPYS' MAGNETOMETER.

(From the London Quarterly Journal of Science.)

**MR. PEPYS** has constructed at the London Institution a new form of voltaic apparatus, it is formed of a single coil of copper and zinc plates, consisting of two sheets of the metals, each 50 feet long by 2 broad, having, therefore, a surface of 200 square feet; they are wound round a wooden centre, and kept apart by pieces of hair-line placed between the plates. The voltaic pile is suspended by a rope and counterpoised over a tub of dilute acid, into which it is plunged when used.

It gives not the slightest indications to the electrometer; indeed its electricity is so weak, that well-burned charcoal acts as an insulator to it; nor does the quantity of electricity appear considerable; for it ignites with difficulty one inch of platinum wire of  $\frac{1}{16}$  inch in diameter. When, however, the poles are connected by a copper wire,  $\frac{1}{8}$  inch diameter, and 8 inches long, it becomes hot, and is rendered most powerfully magnetic; and the instrument is admirably adapted for all electro-magnetic experiments. Dr. Wollaston's well known and curious arrangement of a single pair of plates may justly be called a *calorimeter*; and to Mr. Pepys's coil we may apply the term *magnetometer*.

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**PURPLE DYE**.—On the coast of the Pacific a small shell-fish is found, from which a fine purple dye is extracted, nearly equal in lustre to the Tyrian dye, and the colour never fades. This fish is drawn partly from its shell, and by a slight pressure discharges the dye. This may be repeated several times, but a smaller quantity of dye is obtained each time; and at last the fish dies from the want of the fluid.—*Hamilton's Travels in Colombia*.

**FIGURE OF THE EARTH**.—It appears by recent experiments to be proved, that the flattening of the earth in both the northern and the southern hemispheres is the same.

**THE MACHINE AT MARLY** cost, without the pipes or aqueducts, nearly £360,000.

END OF VOL. IV.

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